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US Army Corps
of Engineers
Vicksburg District

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Red River
Backwater Area

Black River, Louisiana
Tensas-Cocodrie Pumping Plant, Gravity Drainage Structure, and Upper Weir Foundation Report

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TENSAS COCODRIE PUMPING PLANT
GRAVITY STRUCTURE AND
UPPER WEIR

CONSTRUCTION FOUNDATION REPORT

U.S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

AUGUST 1996

PREFACE

This Construction Foundation Report was prepared by the staff of the Vidalia Area Office and Vicksburg District Office, Geotechnical Branch under the direction of the Area Engineer, Vidalia Area Office, Vicksburg Army District, in accordance with ER 1110-1-1801.

TENSAS COCODRIE PUMPING PLANT
UPPER WEIR
GRAVITY STRUCTURE

CONSTRUCTION FOUNDATION REPORT

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TENSAS-COCODRIE PUMPING PLANT AND
GRAVITY DRAINAGE STRUCTURE

FOUNDATION REPORT

SECTION I - INTRODUCTION

1-01. Description. The Tensas-Cocodrie project, located in Concordia Parish Louisiana, approximately 18 miles south of Jonesville, Louisiana (Plates 1 and 2 and Photograph 1) is in a relocation of the Black River Levee near Wild Cow Bayou at approximately Mile 14 on the Black River (Plate 3 and Photograph 2). A gravity structure is located immediately south of the pumping plant (Plate 4). A concrete control weir is located at the confluence of Wild Cow Bayou and Bayou Cocodrie at approximately Mile 20 (Plate 5 and Photograph 3). The Pumping Plant transitions into the Black River Levee via a floodwall as shown on Plates 6 and 7.

1-02. Construction Authority. The Tensas-Cocodrie Pumping Plant was authorized by the Flood Control Act of 27 October, 1965. Channel improvements and the gravity structure were authorized under the discretionary authority of the chief of Engineers as granted by the Flood Control Act of 18 August, 1941.

1-03. Purpose of Report. This report may be used in planning additional foundation treatments should a future need arise, in evaluating the cause of failure, in planning remedial action should failure or partial failure of the structure occur as a result of foundation deficiencies, for guidance in planning foundation explorations, and in anticipating foundation problems for future comparable construction projects.

1-04. Contractors and Contract Supervision. The structures for this project were constructed under two separate contracts.

a. S.J. Potashnick Construction Co., of Cape Girardeau, Missouri, was awarded the contract for the upper weir and gravity structure. The work began 26 October, 1979, and was completed on 24 May, 1982, for the amount of $11,402,654.18.

b. Rosiek Construction Co., Inc. of Arlington, Texas, was awarded the contract for the pumping plant. The work began 13 August 1983, and completed 30 September 1988. Final cost of construction was $18,382,913.53.

c. The administration and supervision of the construction contracts were delegated by the Contracting Officer to the Vidalia Area Office, Vidalia, Louisiana. The Area Office performed the necessary job inspection and supervision through its Project Office at the construction site.

SECTION II - INVESTIGATIONS

2-01. Project Development.

a. Initial Plan. As originally envisioned, the Tensas-Cocodrie Pumping Plant was to supplement the Bayou Cocodrie Drainage Structure located at the confluence of Bayou Cocodrie and the Red River. The initial investigations evaluated two potential construction sites located in backswamp areas east and west of the existing drainage structure. Five borings were utilized in this investigation (10-66U through 14-66U), the results of which recommended Site 1 for the pumping plant (Site 1 is located east of the existing Bayou Cocodrie Drainage Structure). These investigations are presented in Design Memorandum No. 5 entitled "Site Selection" (February 1967).

b. Expanded Investigations. During the review of Design Memorandum No. 6 entitled "General" (February 1974), a meeting was held in Vicksburg, Mississippi, between personnel from the Vicksburg District, LMVD, and the Office of Chief of Engineers. The meeting was held on 1 and 2 May 1974, for the purpose of expediting approval of DM-6. During this meeting, OCE raised the point that "Massive channel improvements through the Red River Wildlife Management Area should be avoided if possible and alternate plans should be considered to minimize channel work." As a result, federal and state fish and wildlife agencies were contacted and their comments on three alternate plans were solicited. Alternate plans which were examined included:

(1) A pumping plant on Bayou Cocodrie between Mile 4.5 and Mile 6.5 to pump directly into the Mississippi River. (This option was not viable due to the high stages on the Mississippi River and the lack of a suitably large construction site.)

(2) A pumping plant on the Red River without channel improvements. (This alternative was rejected due to the loss of benefits.)

(3) A pumping plant and drainage structure on the Black River adjacent to Wild Cow Bayou. This plan required construction of a weir on Wild Cow Bayou to prevent the new outlet from capturing the headwaters of Bayou Cocodrie. (This plan proved to be a viable alternative and was selected.)

c. Site Selection. Pursuant to the OCE recommendations, two sites between Wild Cow Bayou and the Black River were investigated. Five exploratory borings were drilled at Site 1 and four exploratory borings were drilled at Site 2 by Eustis Engineering during March 1976. In addition, information from 12 existing levee borings (drilled during October and November 1973) were utilized. Based on this information, Site 1,

which is located in a point bar area, was recommended for the pumping plant and gravity drainage structure. For a review of these investigations see Supplement 1 to Design Memorandum No. 6 entitled "General" (May 1976).

d. Site Investigations. Pursuant to the recommendations of Supplement 1 to Design Memorandum No. 6, preliminary investigations for the design of the drainage structure and pumping plant were completed at Site 1. The original (Red River plan) had envisioned a pumping plant to be constructed and operated in conjunction with the existing Bayou Cocodrie Drainage Structure. The revised plan envisioned the construction of both a pumping plant and a gravity drainage structure on the Black River at Wild Cow Bayou. The pumping plant and drainage structure are joined by a floodwall and levee. Associated with this plan was the construction of a weir on Wild Cow Bayou to prevent the new outlet from capturing the headwaters of Bayou Cocodrie. Geological and geotechnical information for both structures was collected simultaneously. Information for the preliminary design included 18 borings drilled during June, October, and November 1976 (three of these borings by Eustis Engineering), the aforementioned five borings drilled by Eustis Engineering in March 1976 (and are presented in Supplement 1 to DM-6), and five levee enlargement borings drilled during October-November 1973. The results of these investigations are presented in Supplement 1 to DM-5 entitled "Site Selection" (February 1977). Additional investigations were performed in January and February 1977 and consisted of 20 undisturbed borings (borings TC-53-77U through TC-72-77U) at the drainage structure-pumping plant site and four undisturbed borings (TC-73-77U, TC-74-77U, TC-77-77U, and TC-78-77U) at the upper weir site. Information collected during this investigation is presented in Design Memorandum 9 entitled, "Foundation and Structural" (April 1979).

e. Ground Water. During the interval 9-13 August 1977, a field pump test was performed at the Tensas-Cocodrie Pumping Plant and Gravity Drainage Structure construction site. A fully penetrating test well was installed between Wild Cow Bayou and the Black River levee opposite approximate levee station 680+00. The test well was located outside the limits of planned excavations, approximately 30 feet north of the gravity drainage structure and 100 feet south of the pumping plant. The well consisted of a 14-inch OD (13.5 inch ID), No. 80 slot, low carbon steel, continuous wire wrap well screen with bottom plate and a 14-inch OD standard black steel riser pipe. The length of screen and riser were 134.15 and 19.2 feet, respectively. The well screen was surrounded by 8 inches of filter gravel "E" which was carefully placed by the tremie method to preclude segregation. An array of 26 piezometers located on four bearing lines was installed to monitor the test. Each piezometer consisted of a No. 10 slot well screen installed in a 6-inch hole with a concrete sand filter. For a review of the Tensas-Cocodrie Pumping Plant

and Gravity Drainage Structure field pump test, see Supplement 1 to DM-11 entitled "Overflow Weir and Gravity Structure Dewatering and Underseepage" (May 1979).

2-02. Preconstruction Explorations.

a. Field Exploration. Field exploration at the pumping plant and gravity drainage structure site were performed concurrently and consisted of 45 borings made during the period 4 October 1973 to 28 July 1977. The Vicksburg District made 38 of the borings and seven were made by Eustis Engineering Company. The borings were drilled to depths ranging between 31 and 302 feet below the natural ground surface and 28 borings extended into Tertiary age deposits. All borings were made using rotary drilling methods with mud. General soil samples were taken with a 2.5 inch ID drive tube and undisturbed samples were taken with a 5 inch ID Shelby vacuum tube. Samples were generally taken on 5 foot intervals or strata change (whichever was less), although selected undisturbed borings were sampled continuously throughout the topstratum. The boring layout is shown on Plate 8. Graphic boring logs are shown on Plates 9 through 20. Plate 21 contains a boring legend.

b. Laboratory Tests. Visual classification was made on all samples. Natural water content determinations were made on all samples except sands. Mechanical analysis and Atterberg Limits were performed on selected samples. Consolidation tests were performed on three selected undisturbed samples of cohesive soils. Shear strength tests were performed on several undisturbed specimens of cohesive soils and consisted of unconfined compression and triaxial compression shear tests. The results of the testing program are contained in DM 9 and DM 11.

c. Wild Cow Bayou Field Exploration. Field exploration for the Wild Cow Bayou Channel enlargement consisted of 14 borings taken about 2000 feet apart during the period 1 through 7 June 1976, at the locations shown on Plate 1A of the July 1976 Tensas-Cocodrie Pumping Plant Design Analysis Report (entitled Wild Cow Bayou Channel Enlargement) prepared by Burk, Burk, Guillot & Spencer and Eustis Engineering Company. In addition four borings were taken at the upper weir site. Borings were made to depths ranging between 60 and 130 feet below the existing ground surface and were terminated after penetrating at least 10 feet into clean sand except for boring TC-74-77U which was advanced into the Tertiary age Catahoula Formation near elevation -160. Undisturbed samples of cohesive or semi-cohesive soils were obtained using a 5 inch diameter vacuum type Shelby tube. Samples were taken at 5 foot intervals or at a change in strata whichever was lesser except below the 100 foot depth where the sampling interval was 10 feet.

d. Wild Cow Bayou Laboratory Tests. Laboratory tests consisted of visual classification, water content determinations, Atterberg Limits, specific gravity determinations, unconfined

compression tests, and unconsolidated undrained (Q) triaxial compression tests. Results of the Atterberg Limits, water contents, and shear strength determinations from the unconfined compression tests are presented in the Wild Cow Bayou Channel Enlargement Design Analysis Report.

2-03. Investigations Made During Construction. No additional investigations were made during construction. However, several investigations have been made since the project was completed and these investigations are described in Section VIII of this report.

SECTION III - GEOLOGY

3-01. General. The Tensas-Cocodrie flood control project is located on the Eva, Louisiana, quadrangle approximately 18 miles south of Jonesville, Louisiana. The geology of the area is presented in Waterways Experiment Station Technical Report No. 3-757, "Geological Investigation of the Boeuf-Tensas Basin, Lower Mississippi Valley", by R.T. Saucier. Technical Report No. 3-757 contains geologic maps and cross sections, and presents a classification of alluvial deposits throughout the project area. Alluvial deposits in the Boeuf-Tensas Basin are divisible into a lower, coarse grained substratum and an upper, fine grained topstratum. Topstratum deposits are further classified according to the environment in which they are deposited. Each topstratum category is related to a specific depositional environment in which the constituent materials were laid down in a specific manner resulting in a deposit whose engineering properties vary within known limits. T.R. 3-757 classifies the topstratum deposits at the pumping plant and drainage structure construction sites as point bar in origin. Furthermore, T.R. 3-757 recognizes a thin natural levee deposit at the pumping plant and drainage structure site. Point bar topstratum is deposited on the inside (or point bar) bank of a river bend as a result of meandering of the stream. It often displays an alternating series of ridges and swales. Ridges are remnants of elongated silty, sandy "bars" deposited during high river stages. Swales are thick, clayey deposits that accumulate between ridges during falling river stages. Ridge deposits are relatively thin and sandy (granular). Swales are thick clayey deposits that occur between ridges. Since these ridges and swales can occur as often as 30 per mile, point bar topstratum thickness and lithology can vary greatly over short distances. Natural levee deposits are composed of silt (ML) and sand (SP, SM, SP-SM) which are deposited adjacent to the channel top bank during times of flooding. These deposits are thickest (and coarsest) immediately adjacent to the channel. Technical Report 3-757 indicates that the natural levee deposits range up to 3 feet in thickness. The upper weir site is located in an abandoned channel clay plug. Abandoned channel topstratum deposits are formed when a river cuts off a meander loop. The resulting oxbow lake eventually fills with fine grained clayey deposits and forms a "clay plug" that has the geometry and extent of the parent streams' channel.

3-02. Physiography. The project site is located in the Lower Tensas Basin, a subprovince of the Mississippi Alluvial Valley. The Mississippi Alluvial Valley is located in the Central Gulf Coastal Plain Physiographic Province. The Bayou Cocodrie drainage area, sometimes called the Dismal Swamp Lowlands, is bounded on the east by the Mississippi River, on the south by the Red River and on the west by the Black River. This area contains a complicated network of streams which follow abandoned meander

channels of the Mississippi River. This area was, during the recent geologic past, a part of the active meander belt of the Mississippi River. For this reason, the land surface is characterized by flood plain and meander belt topography of generally low relief. Most of the area is flat, low lying, and has served as a backswamp flood basin for several river courses. Meander ridges and swales, oxbow lakes, and swampy areas which generally mark the site of older oxbow lakes are common in the project area.

3-03. Lithology and Stratigraphy. Both the pumping plant and the drainage structure are located in material classified by their environments of deposition as natural levee overlying point bar deposits. Borings at the pumping plant and drainage structure site reveal a thin layer of natural levee sediments overlying the point bar deposits which are well developed and consist of a thick topstratum of soft-to-stiff, gray-to-brown clays (CH-CL) with occasional lenses of gray, sandy, and clayey silt (ML). The upper weir is located in abandoned channel deposits which consist of soft to stiff clays (CH-CL) overlying a series of interbedded silt (ML) and silty sand (SM). The underlying substratum is composed of sand (SP) that constitutes the alluvial aquifer. Tertiary sediments which underlie the alluvium in the project area are a part of the Catahoula Formation deposited during the Miocene Epoch. The Catahoula Formation in this area consists of several hundred feet of sand and silty sand interbedded with semi-indurated shale and fine-grained sandstone. Contours on the geologic map, Plate 35 of Supplement 1 to GDM 6, show the approximate elevation of the Tertiary surface throughout the project area.

3-04. Structure and Tectonics.

a. General. Regionally the Tensas-Cocodrie Project is located slightly west of the axis of the Mississippi Embayment. Downwarping along the axis of the Mississippi Embayment began during the Jurassic and probably continued into Tertiary time. As a result, Tertiary sediments in the Tensas-Cocodrie area dip towards the south and southeast at approximately 50 to 60 feet per mile. The embayment is filled with transgressive-regressive sediments and capped with Recent (Holocene) materials. The project is located entirely within these Recent materials.

b. Local Structure. The pumping plant is located in the Tensas River Basin-Red River Backwater area which is entirely within the lower floodplain of the Mississippi River. Subsurface geological structures in the area of the project are related to salt movement or differential subsidence of the Mississippi Embayment. No known shallow subsurface structures are located near the project site.

c. Faults. Faulting in this area is deep-seated with no surface expression. Faults present in the Tensas-Cocodrie area are confined to subsurface structures in the Wilcox, Midway, and

older strata. Faulting is known to have occurred at Catahoula Lake, which is a depression created by graben faulting. Catahoula lake is located approximately 20 miles west of the project site. No fault movement has occurred during historical times.

d. Earthquake History. Army publication EM-1110-2-1806 indicates the Tensas-Cocodrie site is located within seismic risk Zone I, which is a zone of low seismic probability. The pumping plant was designed with a seismic coefficient of 0.05g.

3-05. Site Geology. The Tensas-Cocodrie Pumping Plant, gravity drainage structure, and weir are located in the Tensas River Basin and Red River Backwater areas. Ground surface elevations vary from 45 to 50 feet NGVD (National Geodetic Vertical Datum) with relief generally less than five feet. Excavations for the structures did not extend through Recent (Holocene) alluvial materials. These Recent fluvial deposits are divided into a lower coarse-grained substratum and a upper fine-grained topstratum. Investigative borings in the project area indicate the depth to the Tertiary horizon varies from 118 feet (elevation -78 NGVD) to 154 feet (elevation -108) and averaged 142 feet (elevation -98 NGVD). The Tertiary material is composed of green-gray, stiff clay of the Catahoula Formation of the Grand Gulf Group which was deposited during the Miocene Epoch.

a. Pumping Plant. The pumping plant and its approach channel are located in an area of point bar topstratum. Borings of the pumping plant site indicate that the topstratum varies from 33 to 133 feet in thickness (average 86 feet). It is composed of 8 to 13 feet of gray to brown, medium to stiff clays (CH-CL) with slickensides, roots, and silt strata. This is underlain by brown to gray, fine to medium grained sand (SM) that contains lignite and clay strata. Borings along the pumping plant approach channel indicate the topstratum thickness varies from 31 to 58 feet and averages 40 feet. The upper portion of the topstratum is composed of 3 to 17 feet of brown to gray, soft to stiff clays (CH-CL) that contains roots and slickensides. This is underlain by brown to gray, fine to medium grained, topstratum sand (SM) that contains lignite and clay strata. Average substratum thickness varies from 55 feet at the pumping plant to 85 feet beneath the approach channel. The substratum is composed of gray, fine to coarse grained sand (SP) with lignite, gravel, and intermittent clay strata. A geologic profile and a geologic section of the subsurface conditions at the pumping plant are shown on Plates 22 and 23.

b. Gravity Drainage Structure. The gravity drainage structure and its approach channel are located in point bar topstratum. Investigative borings at the gravity drainage structure indicate that the topstratum thickness varies from 58 to 143 feet and averages 111 feet. The top 4 to 10 feet are composed of clay (CH-CL), underlain by random interbedded silt (ML), and

fine-grained sand (SP-SM) which form the rest of the topstratum. The clay (CH-CL) deposits are gray to gray brown, soft to stiff, and contain roots. The silty (ML) materials are gray, sandy, and contain clay strata and wood. The topstratum sand (SP-SM) is fine grained, brown to gray, with lignite, clay strata, and a trace of gravel. Site investigation borings along the gravity drainage structure approach channel centerline indicate a topstratum thickness that averages 34 feet. The natural ground surface is composed of 4 to 13 feet of tan to gray, stiff clay (CH) with slickensides. The remainder of the topstratum section is composed of interbedded, tan to gray silt (ML) and fine-grained sand (SP). Substratum thickness at the drainage structure varies from 3 to 87 feet and from 87 to 111 feet along the approach channel. The substratum is composed of tan to dark gray, fine to medium grained lignitic sand (SP) with a trace of gravel near the base. A geologic profile of the subsurface conditions along the centerline of the drainage structure is shown on Plate 24.

c. Pumping Plant/Gravity Drainage Structure Outflow Channel. Borings in the outflow channel indicate an average point bar topstratum thickness of 23 feet and an average substratum thickness of 114 feet. The topstratum is composed of 3 to 13 feet of gray to brown, medium to stiff clay (CH-CL) overlying a 10 to 20 foot section of interbedded, brown to gray, fine-grained sand (SM) and silt (ML). The substratum in the outflow channel is composed of gray, fine-grained, lignitic sand (SP) with a trace of gravel.

d. Weir. The upper weir is located in an abandoned channel topstratum sequence. Investigative borings at the weir site indicate the topstratum deposits vary from 68 to 98 feet in thickness and average 83 feet. The upper part of the topstratum consists of a layer of clay (CH) that averages 51 feet in thickness. The clay (CH) is gray to brown, soft to stiff, and contains slickensides, concretions, wood, roots, lignite, silt and sand strata, and is crumbly in certain horizons. It is underlain by a series of gray, interbedded silt (ML), silty sand (SM), and fine sand (SP). The silt (ML) deposits contain clay strata and the sand is fine to medium grained material with lignite, clay strata, and gravel. One boring (TC-74-77U) at the weir site completely penetrated the substratum and indicated its total thickness to be 80 feet. The substratum is composed of gray, fine to medium grained, lignitic sand (SP-SM) with a trace of gravel. A geologic section showing the subsurface conditions at the upper weir site is presented on Plate 23.

SECTION IV - DESIGN CONSIDERATIONS

4-01. Design Parameters. As a result of the laboratory testing outlined in Paragraphs 2-02b and 2-02d, the following design parameters were established for use in the design of the Tensas-Cocodrie project.

a. Unconsolidated Undrained "Q" Shear Strength for Point Bar Surface Clay. Unconsolidated undrained (Q) triaxial and unconfined compression test results were considered for the selection of shear strength for the point bar surface clay unit. However, emphasis was placed on triaxial test results in choosing the design value. The near surface clay stratum was assigned a value of 400 psf and a saturated unit weight of 115 pcf. Point bar clay strata that occurred at depth were assigned shear strengths based on test results from adjacent borings and ranged up to 1000 psf.

b. Unconsolidated Undrained "Q" Shear Strength for Abandoned Channel Clay (Upper Weir Site). A plot of unconsolidated undrained (Q) triaxial and unconfined compression test results was used to select design shear strengths for the upper weir site. A value of 400 psf was used above elevation 25 and a value of 740 psf was used below elevation 25.

c. Consolidated Drained "S" Shear Strength for Clays. A design value of 22 degrees for the angle of internal friction and zero cohesion were assigned based on past experience with similar soils.

d. Silt and Sand. Design shear strength for silt was estimated based on experience with this type soil within the Mississippi River Alluvial Valley. A consolidated undrained (R) strength of 300 psf cohesion and 20 degrees angle of internal friction was used for silt. A consolidated drained (S) strength of ϕ=30° and zero cohesion was used for sand.

e. New Levee. The on-site excavated cohesive and semi-cohesive soils (CH, CL, and ML) were used for construction of the new north and south side levee tie-in. To minimize settlement and/or shrinkage of the fill and to develop adequate shear strength, a controlled compaction procedure of 95% of maximum dry density was used as per ASTM D698-70, Method D. An assumed Q shear strength of $c = 1000$ psf, $\phi = 0°$ was used based on experience with this type material compacted as specified.

4-02. Geotechnical Design. The geotechnical design for the individual components of the Tensas-Cocodrie Project is contained in the following Design Memorandums; "Design Analysis - Wild Cow Bayou Channel Enlargement (July 1976), DM No. 9, "Foundation and Structural" (April 1979), and DM No. 11 "Overflow Weir and Gravity Structure".

a. Slope Stability. Sliding stability analyses were performed for the intake and discharge channel slopes at the pumping plant, drainage structure and upper weir, excavation slopes for the structural excavations, and the new levee tie-in on the north and south side. The methods used were the Lower Mississippi Valley Division Method of Planes and Wedges as defined in EM 1110-2-1902 dated 27 December 1960. Considering that the substratum sand will be dewatered during excavation, only the end of construction case was analyzed for the structure excavation. For the inlet and outlet channel slopes and the new levee tie-in the end of construction and sudden drawdown cases were considered.

(1) Structure Excavations. End of construction sliding stability analyses were performed for excavation slopes at all three structures using the most critical cross-section. For those wedges that did not involve the cofferdam, the minimum computed safety factors were 1.37 (upper weir), 2.05 (drainage structure), and 1.9 (Pumping Plant). Stratification and shear strengths for these calculations are based on the following borings: Pumping Plant (Boring TC-68-77U); Drainage Structure (Boring TC-40-77U); Upper Weir (Plot of data from Borings TC-73-77U, TC-74-77U, TC-77-77U, and TC-78-77U). Results indicate an acceptable safety factor for excavation slopes at each structure.

(2) Channel Slopes. Sliding stability analyses for the intake and discharge channel slopes were performed for cross-sections located adjacent to intake and discharge ends of the pumping plant and drainage structure. The Wild Cow Bayou Channel was analyzed at the upper weir site. Cases considered for the pumping plant and drainage structure channels were sudden drawdown, end of construction, and long term (S); with the sudden drawdown being presented in the D.M.'s. The upper weir channels were evaluated for end of construction and long term (S) stability both of which are presented in the D.M. Shear strengths and soil stratification were based on the following borings: (1) Pumping Plant - borings TC-41, 42, 43-77U (Inlet Channel) and TC-53, 54, 49-77U (Outlet Channel). (2) Drainage Structure - borings TC-40-77U (Inlet Channel) and TC-51-77U (Outlet Channel). (3) Upper Weir - borings TC-12-86U through TC-16-76U. The resulting minimum computed sudden drawdown safety factor for each channel was as follows: (1) Pumping Plant - 1.6 (inlet), 1.38 (outlet); (2) Drainage Structure - 1.34 (both inlet and outlet), (3) Upper weir - 1.365 (Reach III of Wild Cow Bayou Enlargement). The computations indicate that the resulting safety factor exceeds the minimum required for all cases.

(3) New Levee Tie-In. Sliding stability analyses for the new levee tie-in were performed to determine the Factor of Safety for the levee embankment, and to assure that the new levee will be terminated, and the floodwall will begin, at a safe distance from the intake and discharge basins. In addition, a typical cross-section perpendicular to the levee centerline was

analyzed. Cases considered were sudden drawdown and end of construction with the sudden drawdown case being presented on the drawings. Shear strength and soil stratification were based on the following borings and resulted in the following minimum factors of safety; south levee (adjacent to the pumping plant stilling basin) - boring TC-56-77U, SF = 1.3; north levee (adjacent to pumping plant stilling basin) boring TC-35-77U, SF = 1.8; new levee (typical section) boring TC-72-77U, SF = 1.29. The results show an adequate safety factor exists for the embankment sections.

(4) Floodwalls.

(a) T-Type Floodwalls. Floodwall monolith types A and B were designated as T-type cantilever walls with sloping bases. The base width and key depth were sized to produce a minimum 1.5 sliding safety factor for the loading case when the river is at elevation 68.7 as computed in accordance with DIVR 1110-1-400, "Soil Mechanics Design Data" (and subsequent revisions) 5 September 1967. The upper clay strata under floodwall Monoliths A and B was removed by excavating to elevation 35.0 and backfilling with pervious backfill "B" beneath the base of the floodwall. This excavation was considered necessary to reduce anticipated settlement of the floodwalls and to improve the sliding stability. Soil parameters used were as follows:

$$W = 120 \text{ pcf}, \ \phi = 25°, \ C = 0 \text{ psf}$$

The most critical loading case for sliding and overturning was computed with the river at elevation 68.7 (and a corollary uplift acting on the base of the structure) resulted in a minimum sliding factor of safety of 1.56 for Monolith A and 1.51 for Monolith B.

(b) I-Type Floodwalls. Floodwall Monoliths C-1, C-2 and C-3 were designed as I-type cantilever sheet piling walls with a reinforced concrete cap. Computations were made to determine the required sheetpile penetration and maximum bending moment for a steel sheetpile for each monolith. The computations were performed in accordance with the procedures outlined in DIVR 1110-1-400, Soil Mechanics Design Data (and subsequent revisions) 5 September 1967, Section 5, Part 5, Item 1. An "S" strength of $\phi = 25°$ and C = 0 psf was assigned for computation of the active and passive soil pressures. The critical loading case for this monolith occurs with the river at elevation 68.7 and a seepage pattern developed under the sheetpile base.

(5) Pumping Plant Monoliths. Sliding stability, overturning stability and floating stability analyses were performed for the pumping bay and end bay monoliths. Soil parameters used for the in-situ sand below the pumping plant monoliths are as follows:

$$W = 120 \text{ pcf}, \ \phi = 30°, \ C = 0 \text{ pcf}$$

Construction, normal operating, and extreme operating cases were analyzed as follows: (Ia) end-of-construction, (Ib) end-of-construction with wind, (IIa) normal operating condition low sump, (IIb) normal operating condition high sump, (IIIa) extreme operating condition high river-low sump, (IIIb) extreme operating condition high river high sump, and (IIIc) earthquake loading. The critical loading case for computing overturning stability of the pumping bay monolith was Case III-C Earthquake loading. The floating stability of the pumping bay monoliths was critical with Loading - Case IIIB (high river and high sump condition). The minimum floating factor of safety was 1.51. The sliding stability of the pumping bay monolith was critical for Loading Case III-A (high river and low sump condition). The minimum sliding factor of safety was 1.59 with the intake structure operating and 1.13 with the pump monolith alone. The critical loading case for computing overturning, floating and sliding stability of the end bay monolith was Loading Case III-A with the river at elevation 65.7, and the water surface at the ground elevation of 50.0 landside of the structure.

(6) Intake Structure. Intake Monoliths I and II were analyzed for floating stability assuming the same Loading Cases outlined above. The base slab thickness and heel dimensions were chosen to provide a minimum floating factor of safety of 1.0 for Case III, when the sidewall drains are blocked, and one bay is dewatered.

(7) Retaining Walls. The intake and outlet retaining walls were designed as T-type cantilever retaining walls. Each monolith was analyzed for overturning and sliding stability checking Loading Cases I, II, and III. The width of base of reach monolith was selected to provide a minimum sliding factor of safety of 1.5 for active-passive sliding and 1.3 for at rest-passive sliding with Case II loading, using the equivalent fluid pressures method of sliding analysis. Sample calculations for the stability analyses of the retaining walls are shown on Sheets 3-46 through 3-57, DM No. 9.

b. Foundation Design.

(1) Bearing Capacity. Computations to determine the ultimate soil bearing capacity were made using the Terzaghi formula considering general and local shear failure. All structural components except the upper weir are supported directly on the natural sand stratum. The computations indicate that adequate soil bearing capacity exists beneath these structures. The floodwalls are supported on the compacted levee fill. Using a cohesion of 1000 psf, an ultimate soil bearing capacity of 3430 psf is indicated for design purposes. The value of 1000 psf was assumed but was verified by shear strength tests on samples of the material used for the compacted fill.

(2) Settlement. It was estimated that settlement of the pump station and wingwall monoliths (I through V) supported on natural subsoils should be small and should not exceed 0.25 to 0.5 inch. This estimate was based on consideration of the relative incompressible nature of the underlying subsoils and that the load imposed by these structures (and adjacent backfill) does not exceed the overburden pressure existing prior to excavation. It was estimated that the settlement of the floodwall and wingwall monoliths (VI, VII, VIII and IX) supported on the compacted fill material may range between 0.5 and 1.0 inch. This estimate was based on the assumption that a considerable portion of the fill materials will be placed prior to construction. Detailed settlement analyses for the structures supported on compacted fill required consolidation tests to be run on compacted specimens of the fill material as well as consideration of the sequence of construction.

4-03. Seepage Control and Construction Dewatering.

a. Preconstruction Pumping Test. A field pumping test was performed from 9 through 13 August 1977 at the site of the Tensas-Cocodrie Pumping Plant and Gravity Drainage Structure to determine as accurately as possible the foundation permeability for use in underseepage and dewatering analysis. A test well that fully penetrated the substratum and piezometers were installed as outlined in Paragraph 2-01(e). Permeability was computed based on the pumping test results. Horizontal permeability chosen for the underseepage and dewatering analyses was 0.28 foot/minute.

b. Dewatering. Dewatering requirements closely follow the Guide Specifications for Dewatering (LMKSP-GS-003 Section 2). The major requirements were as follows: Lower the free water surface in the substratum sand 5 feet below the bottom of the excavation and the bottom of the side slopes; collect and dispose of all surface water; install a system of construction piezometers to monitor the freewater surface; provide a system to meter effluents from the dewatering system; provide a means of monitoring sanding.

(1) Pumping Plant. A dewatering analysis for the pumping plant excavation was made and is presented in Section III of the Tensas-Cocodrie Pumping Plant Supplement No. 1 to DM 9, Underseepage and Dewatering dated October 1979. Two systems were analyzed with the least cost potential based on previously completed analyses conducted on the Gravity Drainage Structure. Considering artisan flow, it was necessary to use wells that fully penetrated the substratum sand to reduce the piezometric level in the substratum sands and dewater the topstratum sand and overlying soils using a complimentary system. The two systems analyzed were as follows:

(a) Ten deep wells, 14 inches in diameter that fully penetrated the substratum and with eight partially penetrating wells 8 inches in diameter.

(b) Ten fully penetrating deep wells, 14 inch diameter with a four stage conventional well point system (as shown on Plate III-3).

The system actually installed by the contractor consisted of eight deep wells that fully penetrated the substratum and ten piezometers. The eight deep wells performed satisfactorily due to generally optimum conditions; i.e. relatively low river stages during construction. At the completion of dewatering the equipment was removed and the holes plugged. This system is described in Paragraph 5-02.

(2) Gravity Drainage Structure and Upper Weir. Analyses of the construction dewatering requirements for the gravity drainage structure and the upper weir were made in Sections III, IV, V and VI of Tensas-Cocodrie Pumping Plant, Black River Alternate, Overflow Weir and Gravity Structure, Dewatering and Underseepage dated May 1979. Several alternatives were analyzed with the least costly alternative being Method 2 (fully penetrating well in combination with partially penetrating wells for the Gravity Structure, and Method 1 (deep wells) for the upper Weir.) Eight deep wells and four piezometers were installed at the gravity drainage structure during construction. Four deep wells and one piezometer were installed at the upper weir. The construction dewatering performed satisfactorily and at the completion of dewatering, the equipment was removed and the holes plugged. The dewatering effort is discussed in Paragraph 5-02.

c. Seepage Control.

(1) Pumping Plant. In order to control uplift pressures and piping of fine grained soils, materials beneath the inlet slab and for 70 feet upstream of the inlet slab were overexcavated with the bottom width of the trench being the width of the inlet channel. The depth of the over excavation was to elevation 5 (NGVD), or deeper if necessary, to remove all CH, CL and/or ML soils. A pervious backfill was used to fill the overexcavated trench. The inlet slab was constructed 50 feet long and 7 feet deep with an additional 1 foot long key added to its edge. The inlet slab is tied structurally to intake monolith II but independent of the retaining walls. A 10 foot sheet pile cutoff was provided at the key of the inlet slab. Also an underdrain consisting of 6 inches of filter sand "A" and 6 inches of filter gravel "B" was used beneath the slab. The outlet slab is 50 feet long and 5 feet thick. A three-foot key was constructed at the slab edge with a 10 foot long sheet pile cutoff extending down from the key.

(2) Gravity Drainage Structure. The results of the underseepage analysis indicated the need to over excavate the foundation silt in order to make the structure safe against piping at the edge of the approach slab (FS = critical gradient - exit gradient). Therefore, the silt under the approach slab was

overexcavated for 80 feet upstream of the edge of the approach slab and backfilled with pervious sand. The extent of actual excavation was determined in the field during excavation of the silt. The overexcavated areas were backfilled with SP or SP-SM material having less than 12 percent passing the 200 sieve.

SECTION V - EXCAVATION PROCEDURES FOR COMPONENT PARTS

5-01. Excavation Grades and Slopes.

a. Pumping Plant. Excavation was performed from a maximum natural ground elevation of 45.0 to elevation 5.0. The 5.0 elevation was in the area of the discharge apron. The excavation grade beneath the pumping plant monoliths was elevation 11.0. The inlet channel slopes were 1 on 3 from the ground surface to the final grade of 20.0. The outlet channel slopes were 1 on 3 from the ground surface to the final grade of 24.0. The excavation plan for the pumping plant is shown on Plate 25. Structural excavation sections at the pumping plant are shown on Plate 26. Photographs 4 and 5 show the completed foundation and early concrete placements at the pumping plant. The levee tie-in has a 25 foot crown with a 1 on 4 slope from elevation 68.7 to natural ground on the riverside. The landside configuration has a 1 on 3.5 slope from elevation 68.7 to elevation 58.9 and a 1 on 5.5 slope from elevation 58.9 to existing ground. The design also includes a landside seepage berm extending from elevation 55.4 on a 1 on 30 slope to a distance 240 feet from the levee centerline. The excavation plan and sections for the floodwall portions of the levee tie-in are shown on Plates 6 and 7 and Photographs 6 and 7.

b. Gravity Drainage Structure. Excavation was performed from a maximum natural ground elevation of 45.0 to elevation 0.0. The grade along the conduits varied between elevation 13.5 and elevation 10.0. The inlet channel slopes were 1 on 3 from the ground surface to final grade at elevation 18.0. The outlet channel slopes were 1 on 4 from the ground surface to final grade at elevation 9.0. The excavation plan for the gravity drainage structure is shown on Plate 27. Photograph 8 shows construction of the gravity drainage structure.

c. Upper Weir. Excavation was performed from a maximum natural ground elevation of 40.0 to elevation 16.25. The main structure was excavated to elevation 18.0. The 16.25 elevation was for an underdrain system. Upstream channel slopes were 1 on 3 immediately above the structure. The slopes transitioned to 1 on 4 approximately 120 feet above the structure. Downstream channel slopes were 1 on 3. All slopes extended from natural ground to the final channel grade at approximately elevation 23. The excavation plan for the upper weir is shown on Plate 28. Photograph 9 shows an aerial view of the construction of the upper weir.

5-02. Dewatering Systems.

a. Pumping Plant. The dewatering system for the pumping plant consisted of 8 deep wells located around the perimeter of the excavation. Each well had 40 feet of screen.

Each well was installed in a borehole between 130 and 140 feet deep. The wells were connected to 30 HP MTA#100 TSHH turbine submersible pumps. Ten 2-inch diameter piezometers with 30-inch screens were installed to monitor subsurface pressures. Location of the dewatering system is shown on Plate 26. Photograph 10 shows a typical dewatering well.

b. Gravity Drainage Structure. The dewatering system for the gravity structure consisted of 8 deep wells, 4 at each end of the structure excavation. Each well had 40 feet of 16" steel screen in a 30" diameter hole. The wells were 135 feet deep with pumps set 60 feet below grade. The pumps were model 12 FHM Vertiline pumps powered by 60 HP 353 Detroit Diesel engines. Four piezometers were installed to monitor subsurface pressures. Location of the dewatering system is shown on Plate 27.

c. Upper Weir. The dewatering system for the upper weir consisted of four Vertiline Model 12 FHM pumps each powered by a 60 HP 353 Detroit Diesel engine. The pumps were designed to maintain a piezometric level three feet below excavation surfaces for a level in Wild Cow Bayou up to and including elevation 47.0. Two construction piezometers, each consisting of a standard well point on a PVC riser, were installed to monitor subsurface pressures. The layout of the dewatering system is shown on Plate 28.

d. Design Requirements. The contractual requirements for the construction dewatering systems consisted of controlling surface water and maintaining a water table below the excavation grade. The water table was maintained 5 feet below the excavation and side slopes at the gravity structure and pumping plant and 3 feet below the excavation and side slopes at the weir. Additionally, excess hydrostatic pressures in the pervious sand stratum underlying the abandoned channel topstratum clay was lowered to a point 3 feet below the bottom and side slopes at the upper weir.

5-03. Foundation Preparation. Structural excavation at the pumping plant was performed using a Bucyrus Erie 71 B dragline and 5 Euclid bottom dumps. Structural excavations for the gravity structure and upper weir were accomplished using a dragline and bottom dumps. Certain foundation areas beneath the gravity drainage structure and pumping plant did not completely penetrate through the point bar topstratum. In these areas, unsuitable, fine grained materials were removed and replaced using clean sand (photograph 11). The excavation for the upper weir was confined to Abandoned channel clays and the structure was founded on steel "H" piles as described in Section 6-02.

5-04. Unusual Problems. Foundation excavations for the Pumping Plant and Gravity Drainage Structure proceeded as designed and no unusual problems were encountered. At the upper weir site a slide developed in the abandoned channel clay in the upstream

cofferdam foundation. The slide was remedied by loading the toe of the active wedge stabilizing the slide throughout the construction period (photograph 12). The cofferdam was removed at the completion of construction.

SECTION VI - CHARACTER OF THE FOUNDATION

6-01. Character of Foundation. The pumping plant and gravity drainage structure are founded on alluvial point bar topstratum materials. This stratum is composed of fine-grained silty sand (SM) with lignite particles, rootlets, and clay strata. The upper weir is located in an abandoned channel deposit and was constructed on a steel H-pile foundation.

6-02. Foundation Piling at the Upper Weir. The upper weir structure is supported on a total of 192 H 14x73 bearing piles. Each upstream retaining wall is supported on 22 piles. Each downstream retaining wall is supported on 30 piles. The weir itself is supported on 88 piles. Five of the permanent piles were driven as test piling. One test pile was driven under each retaining wall and one test pile was driven under the west slab of the main structure. Fifteen battered piles were driven under each upstream retaining wall. Sixteen battered piles were driven under each downstream retaining wall. Twenty-six battered piles were driven beneath the weir itself. Sixty-two piles were attached to tension anchors. Test piles under the walls were driven to a tip elevation of -80. The test pile beneath the main weir was driven to an elevation of -90. Other piles were driven to elevations between -45 and -50 beneath the upstream walls, between -52 and -82 beneath the main structure and between -40 and -60 beneath the downstream walls.

6-03. Pile Driving Operations. The pilings were driven with a Vulcan 08 pile hammer attached to an American 9260 crane and two air compressors. The air compressors delivered a combined 600 cfm to the hammer. The hammer was a single action hammer with an impact energy of 26,000 ft. lbs. The weight of the hammer was 16,750 lbs. and its length was 15 feet. Leads for the operation were 120 feet with an 8" x 26" section and a weight of 150 plf. A Northwest 95 crane and two dozers assisted in the operations. Pile driving operations began on 16 June 1981 and were completed on 23 July 1981. A total of 15,703 lf of piling was driven (Photograph 13).

6-04 Geologic Mapping Program. During the construction period personnel from the Vicksburg District, Engineering Division, Geotechnical Branch, examined and mapped the exposed geology in the opened excavation. At the pumping plant and gravity drainage structure site, the alluvial point bar topstratum was completely penetrated by the excavation and the unit was mapped. The alluvial substratum and the Tertiary Formation were mapped based on information from exploratory borings. At the upper weir site, the abandoned channel deposit was examined and mapped in the field. The geometric extent of this deposit, as well as the substratum and Tertiary Formation were inferred from investigative borings. The geologic maps for this project are presented on Plates 22, 23, and 24.

SECTION VII - FOUNDATION TREATMENTS AND INSTRUMENTATION

7-01. Excavation and Backfill.

a. Pumping Plant. The pumping plant excavation was to elevation 9.0 as shown on plate III-27, DM 9, Foundation and Structural", and Plate 25. Portions of the pumping plant foundation were overexcavated to prevent seepage problems as discussed in Paragraph 4-03(c). The foundation for the floodwalls was overexcavated to remove compressible materials and backfilled with sand to prevent settlement as discussed in Paragraph 4-02(a)(3). The excavated material was used as backfill material to build a cofferdam around the excavation and for levee fill material for the new levee south of the pumping plant. The pumping plant channel excavation was used as borrow material available for backfill around the pumping plant. Surplus excavated material was deposited on the top bank on both sides of the inlet and outlet channels within the project's right-of-way as shown on Plate I-3, DM 9. Plates 29, 30, and 31 show the backfill areas and the collector systems installed at the pumping plant. Plates 6 and 7 show the excavation and backfill for the floodwalls. Photographs 14 through 19 show the backfilling operation around the pumping plant and floodwalls. Photograph 20 shows the installation of the backfill collector pipe for the backfill drainage system at the pumping plant.

b. Gravity Drainage Structure. The new highway bridge and temporary by-pass road on Louisiana 129 was constructed under a contract by the Louisiana Highway Department. The gravity drainage structure inlet channel served as a drainage outlet for the area bounded by the Black River Levee, Louisiana 129, and the gravity structure inlet channel on the north. The embankment for the new access road shown paralleling the inlet channel on Plate I-2 would have blocked Wild Cow Bayou at Louisiana 129, therefore, the new bridge and inlet channel were constructed during the early stages of the project. The cofferdam on Plate III-23 protected both the gravity structure and the pumping plant excavation. The existing Black River levee was not degraded until the gravity drainage structure, pumping plant, and related levee setbacks were in place. The cofferdams, upper weir, cut-off channel, storage area fill, access road, gravity structure, and those portions of the gravity structure channel shown on Plate I-7 were included in the first phase of construction. The pumping plant and other related facilities comprised the second construction phase. Excavation for the gravity drainage structure extended into the substratum sand unit. This required minor amounts of over excavation to remove unsuitable materials from the foundation areas. Over excavated areas were backfilled with clean sand. The barrels of the gravity drainage structure were encapsulated in sand "B" beginning at the upstream end and extending for a distance of 187.5 feet to prevent piping. The stilling basin originally contained a pressure relief filter system with a

collector system. This system has since been de-activated as discussed in Section 8. The backfills behind the landside and riverside retaining walls and wing walls contain a collector system. The details of the backfills, filters, and collector systems at the gravity drainage structure are shown on Plates 32 through 35. Photograph 21 shows the installation of the backfill behind the downstream wing walls.

c. Overflow Weir. The construction sequence for the overflow weir was as presented in paragraph 1-05 of DM 11, Overflow Weir and Gravity Structure. Construction of the new cut-off channel shown on Plate I-2 DM 11 and the upper weir cofferdam was coordinated to maintain the water level above the existing Louisiana Department of Wildlife and Fisheries weir on Bayou Cocodrie to a minimum height equal to elevation 33 or the crest height of the existing weir. This was accomplished by maintaining the upper weir cofferdam at elevation 33 while the new cut-off channel was being constructed. After the cut-off channel was completed, the upper weir cofferdam was raised to elevation 48 during construction. Relocation of the existing bridge in the vicinity of the upper weir and the new bridge located at the northeast limit of the new cut-off channel were constructed under separate contracts by Concordia Parish. The upper weir is equipped with an underslab filter system to collect and discharge excess pressures to tail water elevation. Backfills behind the upstream and downstream retaining walls contain collector systems. The backfills and collector systems for the upper weir are shown on Plates 36 and 37. Photograph 22 shows the instillation of the backfill behind the wing walls at the upper weir.

7-02. Sheetpiling.

a. Pumping Plant. Sheet pile cut-off walls were driven beneath the pumping plant structure at both upstream and downstream ends, beneath the approach slab and discharge apron, and beneath the wing walls. Sheetpiling in these areas was type PSA 23. Sheet pile cut-offs were also placed on both sides of the floodwalls. Sheetpiling in these areas was type PSA 23 and type PMA 22. All sheetpiling was 15 feet long. Plate 38 shows the sheet pile layout at the pumping plant. The sheet pile layout beneath the floodwalls is shown on Plates 6 and 7. Photograph 23 shows the installation of the sheet pile cut-off at the pumping plant.

b. Gravity Drainage Structure. Sheetpiling was driven at the gravity structure to form a ground water cut-off beneath the retaining walls and the stilling basin. Approximately 1241 sq. ft. of sheetpiling were driven to an elevation of 12.2. Sheetpiling was type PSA-23 perpendicular to the structure centerline and type PMA-22 along the sides. Sheetpiling was driven with a #7 Mikiernan-Terry air powered hammer supported by a 3900 Manitowoc crane and driven by a 600 cfm air compressor. The hammer had a striking energy of 4150 ft.lbs. The location and

penetration of the individual sheet pile segments is shown in Section 4 of the "as built" construction drawings. Sheetpile installation is shown on Photograph 24.

c. Overflow Weir. Sheetpiling at the upper weir was driven as a cut-off wall on both the downstream and upstream edge of the structure. Sheetpiling was type PMA22. Sheetpiling was driven to elevation 7.0. The instillation operation used the same equipment as at the gravity structure. Approximately 2982 sq. ft. of sheetpiling were driven. The location and penetration of the sheet pile segments is shown on drawing 4/29 of the "as built" construction drawings.

7-03. Filters.

a. Pumping Plant. The underdrain system for the pumping plant consists of several different types of material. The gradation of each material is tabulated below. Pervious backfill "A" was used as backfill behind the retaining walls. Pervious backfill "B" was used beneath the floodwalls. Pervious backfill "B" was also used to backfill overexcavated areas. A 6-inch layer of filter gravel, a 6-inch layer of filter sand, and a 4 foot layer of pervious backfill "C" were used beneath the approach slab. (Please note that filter sand and pervious backfill "C" have the same gradation.) Pervious backfill "C" was used beneath the discharge apron and retaining walls. An 18-inch layer of filter gravel and a 12-inch layer of filter sand were used beneath the riprap in the approach channel. Pervious backfills "A", "B", and "C" required compaction to 80% relative density in accordance with ASTM D 2049. Pervious Backfill "A" was defined as being a clean, free draining material with less than 5 percent passing the #200 sieve. The gradations for pervious backfill "B" pervious backfill "C", and filter gravel are shown on the following tables. The backfilling operation is shown on Photographs 14 through 17 and 20.

Pervious Backfill "B"

U.S. Std Sieve	Permissible Limits % By Wt., Passing
3/8 inch	100
#4	90 - 100
#20	35 - 100
#50	10 - 80
#70	0 - 60
#200	0 - 12

Pervious Backfill "C" and Filter Sand

U. S. Std Sieve	Permissible Limits % By Wt., Passing
3/8 inch	100
#4	90 - 100
#16	45 - 80
#50	7 - 30
#100	0 - 2

Filter Gravel

U. S. Std Sieve	Permissible Limits % By Wt., Passing
2 1/2 inch	85 - 100
1 1/2 inch	75 - 95
1 inch	55 - 80
1/2 inch	30 - 50
#4	5 - 15
#8	0 - 5

b. Gravity Drainage Structure. The underdrain filter system used in the approach slab and stilling basin are described in Section 3-05 and shown on Figures 4 and 5, respectively, of DM 11, Supplement 1, Overflow Weir and Gravity Structure. A three layer system was used at the inlet end of the structure with the bottom most layer consisting of the backfill material used in the excavated area. Filter sand "A" and filter gravel "B" used beneath the approach slab and stilling basin are shown on Figures 6 and 7, respectively, of DM 11, Supplement 1. Photograph 21 shows the backfilling operation at the drainage structure. Gradations are as follows:

Sand "A"

U. S. Std Sieve	Permissible Limits % By Wt., Passing
1/2 inch	100
3/8 inch	98
#4	90
#8	68
#10	63
#16	45
#20	34
#200	0

Gravel "B"

U. S. Std Sieve	Permissible Limits % By Wt., Passing
6 inch	100
4 inch	95
2 inch	80
1 inch	57
1/2 inch	29
3/8 inch	24
#4	8
#10	0-5

c. Upper Weir. The underdrain filter system for the upper weir was located beneath the slab. The filter consisted of 12 inches of gravel "B" as described above. The upper weir also contained a backfill collector system. The backfill collector system installation is shown on Photograph 22.

7-04. Channel Protection. Channel protection, consisting of filter fabric, filter sand, filter gravel, and riprap was installed in various locations at the Tensas-Cocodrie project as described in the following paragraphs.

a. Pumping Plant. Channel protection in the intake channel of pumping plant consisted of 18 inches of riprap over 18 inches of filter gravel over 12 inches of filter sand.

Details of the riprap installation for the inlet channel are shown on Plates 3 and 29. Channel protection in the pumping plant outlet channel, immediately downstream of the outlet slab, consisted of 18 inches of riprap over 18 inches of filter gravel over 12 inches of filter sand. This protection extended to station 25+12 (toe of the cofferdam) and is shown on Plate 3. Details of the riprap installation in the outlet channel are shown in the "as built" construction drawings for the pumping plant on drawings 1/4, 2/7 and 2/9. Channel protection downstream of the cofferdam (beginning at station 30+32) and in the common outflow channel consisted of 12 inches of riprap on 6 inches of filter gravel on filter fabric. Details of the channel protection in this area are shown in the "as built" construction drawings for the pumping plant on drawings 1/4, 2/7, and 2/10. The area between stations 25+12 and 30+32 received no channel protection and have since been the subject of remedial efforts. Photographs 25 through 27 show the construction of the channel protection at the pumping plant.

b. Gravity Drainage Structure. Channel protection in the inlet channel of the gravity drainage structure consists of 18 inches of riprap on 9 inches of gravel "B" on 9 inches of sand "A" placed on plastic filter fabric. This channel protection extends approximately 105 feet upstream. Channel protection in the gravity drainage structure outlet channel consists of 42 inches of riprap on 12 inches of gravel "B" on 6 inches of sand "A". This protection extends from the end sill of the stilling basin 75 feet downstream where it transitions into 12 inches of riprap on 6 inches of bedding gravel on plastic filter fabric. Details of the riprap instillation are shown in the "As Built" construction drawing on drawings 2/3, 2/4, 2/5, and 4/2. Problems developed with the performance of the outlet channel riprap due to clogging of the riprap filter system by sediments. The riprap filter system was not capable of relieving excess hydrostatic groundwater pressures and this condition led to the development of sand boils as discussed in paragraph 8-03 of this report.

c. Upper Weir. Channel protection in the inlet channel of the upper weir consists of 12 inches of riprap on 12 inches of bedding gravel. This channel protection extends 58.5 feet upstream. Channel protection in the upper weir outlet channel consists of 18 inches of riprap on 12 inches of bedding gravel. This protection extends from the end sill of the stilling basin 69 feet downstream. The details of the upper weir channel protection are shown on Plate 28.

7-05. Instrumentation.

a. Piezometers. Piezometers were installed at all three structures. Piezometers provide an indication of the effectiveness of the sheet pile cutoffs, provide an indication of the effectiveness of the relief systems (by monitoring pore pressure in underlying substratum and structural backfills), and

measure the general uplift pressures under and within the enclosed portions of the structure foundations. Piezometers were read daily during construction. They were read monthly for the first two years of structure operations and quarterly thereafter. A list of the locations of the piezometers is included below. The details of piezometer installation and floatwell construction are shown on Plates 39 and 40. Photograph 28 shows a typical piezometer installation.

PUMPING PLANT

PIEZ #	TYPE	STATION	OFFSET FROM CL	TIP ELEV.
B-1	BACKFILL	20+85	112'R	16.5
B-2	BACKFILL	22+20	96'R	16.5
B-3	BACKFILL	20+85	112'L	16.5
B-4	BACKFILL	11+20	96'L	16.5
B-5	BACKFILL	23+72	96'L	24.5
B-6	BACKFILL	24+28	120'L	24.5
B-7	BACKFILL	23+72	96'R	24.5
B-8	BACKFILL	24+28	120'R	24.5
B-9	BACKFILL	23+44	240'R	38.0
B-10	BACKFILL	23+20	240'L	38.0
F-1	FOUNDATION	21+36	0'	5.0
F-2	FOUNDATION	21+36	60'L	-5.0
F-3	FOUNDATION	22+82	60'L	-5.0
F-4	FOUNDATION	23+72	60'L	0.0
F-5	FOUNDATION	23+72	60'R	0.0
F-6	FOUNDATION	22+82	60'R	-5.0
F-7	FOUNDATION	21+36	60'R	-5.0
US-1	UNDERSLAB	21+86	18'R	9.0
US-2	UNDERSLAB	21+86	18'L	9.0

GRAVITY STRUCTURE

PIEZ #	TYPE	STATION	OFFSET FROM CL	TIP ELEV.
BF-1	BACKFILL	48+76	47.5'L	17.5
BF-2	BACKFILL	48+76	47.5'R	17.5
BF-3	BACKFILL	55+18	45.0'L	7.0
BF-4	BACKFILL	55+18	45.0'R	7.0
DP-1		54+53	45.0'L	-30.0
SB-1	STILL.BASIN	55+57	0.0'	0.5
SB-2	STILL.BASIN	54+73	0.0'	0.5
AS-1	APP. SLAB	48+16	0.0'	20.5
AS-2	APP. SLAB	48+66	0.0'	13.5

UPPER WEIR

PIEZ #	TYPE	STATION	OFFSET FROM CL	TIP ELEV.
BF-1	BACKFILL	3+27	75.0' L	23.0
BF-2	BACKFILL	3+27	75.0' R	23.0
BF-3	BACKFILL	3+87	77.0' L	23.0
BF-4	BACKFILL	3+87	77.0' R	23.0
W-1	WEIR	3+58	0.0'	17.0
SB-1	STILL.BASIN	3+87	0.0'	17.0

b. Survey Reference Markers. Survey reference markers have been located on all monoliths at all structures. These markers are used to monitor the horizontal and vertical motions of the structure. Reference markers were recorded at the completion of the construction and have been observed annually since.

SECTION VIII - MODIFICATIONS AND POST-CONSTRUCTION PROBLEMS

8-01. General. Remedial efforts have been performed at both the Tensas-Cocodrie Pumping Plant and the Gravity Drainage Structure. The nature of the problems, and the remedies performed are outlined in the following paragraphs.

8-02. Repairs to the Drainage Systems at the Pumping Plant. In April 1989 excessive pressures were noted beneath the approach slab. The Vicksburg District, Foundation and Materials Branch, performed investigations to determine why the excess pressures were not dissipated by the underslab and backfill collector systems. The investigations revealed that the drainage systems were partially blocked as a result of backflooding. The check valves for both the underslab and backfill drainage systems were found to be defective in workmanship and fitting tolerances. Flood waters had backflooded the collector pipes and stopped up the systems. The check valves were removed and an attempt was made to clean the collector pipes. During this cleaning operation a large amount of construction debris, including visqueen, wood, and rubbish, was discovered in the collector pipes. An attempt was made to clean the collector pipes using a high pressure jet sprayer. The underslab drain and the backfill drains were treated with Trisodium Phosphate and the manholes were pumped to "flush" the collector systems. The southwest backfill collector pipe was producing sand which entered the pipe through a defective joint. Thirty feet of #10 slot, 2-inch screen and 3 feet of #10 slot, 4-inch screen were installed in the collector pipe using a figure "K" packer. Gasket material was changed on all check valves and the stabilizer bars were adjusted to assure that each check valve completely sealed the collector pipe. At the conclusion of the repairs both the backfill and underslab collector systems were flowing discolored water indicating that clay and silt particles were being removed from the filters. For a detailed discussion of these remediation efforts see Appendix F of Periodic Inspection Report Number 3, (August 1990).

8-03. Repairs to the Underslab Collector System at the Gravity Drainage Structure. Concurrent with repairing the check valves at the pumping plant, divers were employed to replace the gaskets on the check valves at the gravity drainage structure. The divers discovered a mound of fine gray foundation sand on the stilling basin floor outside the south manhole. The sand had a volume of approximately 6 cubic yards. It was determined that the sand was coming from the underslab drain. A jet sprayer hose was negotiated through the collector pipe and several pieces of wood, up to 10 inches long, were recovered from the pipe. These materials must have been placed in the pipe during construction. In an attempt to salvage a portion of the collector pipe a figure "K" packer was inserted 18 feet south of the north manhole. A 3-1/2 foot section of 4 inch, #10 slot PVC well screen was installed beneath the check valve in both manholes. This

resulted in a substantial lowering of the discharge and the underslab pressures increased approximately 3 feet. However, the sanding was stopped. The next step involved unwatering the stilling basin so that explorations could be undertaken to discover any voids beneath the stilling basin. A cofferdam was constructed across the outlet channel and unwatering commenced on 4 October 1989. As the stilling basin was unwatered small sand boils began to appear along the north and south upstream abutments of the cofferdam. Attempts to control the boils included installing filter fabric and constructing an access ramp over the problem area. On the afternoon of 6 October a large sand boil developed at the intersection of the endsill and the north wingwall. Washed gravel and sand bags were placed over the boil which measured approximately 6 feet in diameter. On the morning of 7 October 1989, the north wingwall monolith was discovered to have moved approximately 6-1/2 inches down and 4 inches outward. On 8 October 1989, the stilling basin was rewatered to elevation 18 to equalize the pressures. Beginning on 23 October, four 8-inch diameter dewatering wells were installed to control ground water pressures. By 18 November 1989, the stilling basin was completely unwatered and the ground water was at elevation 9. Investigations showed that the filter system beneath the riprap was inoperable because it had been clogged with silt and clay. Repairs included the following. Six holes were drilled in the base of the wingwall. A total of 5.5 cubic feet of cement grout was placed in five of these holes and chemical grout in the sixth. The drilling didn't encounter any voids beneath the wingwall base. Chemical grout was also used to repair the expansion joints at each end of the wingwall monolith. Seven holes were drilled through the stilling basin concrete and 33.5 cubic feet of cement grout were injected. No large voids were discovered. A total of 38 cubic feet of grout was placed in the collector pipe via the north and south manholes. It was concluded that the sand that had exited via the manholes had actually traveled from the area behind the stilling basin walls and beneath the backfill. The underslab filter system contained a sand filter on the foundation with a gravel filter overlying the sand filter. No provisions were made to wrap the sand filter around the (lateral) ends of the gravel filter (left and right) and it is postulated that the piping involved movement of foundation sand laterally from the areas beneath the backfills, through the gravel layer and into the collector pipe. Riprap thickness were increased in the channel immediately downstream of the endsill to insure that foundation pressures are adequately contained. No subsequent problems have occurred. For a detailed review of the remedial measures performed see Appendix E of Periodic Inspection Report Number 3, (August 1990).

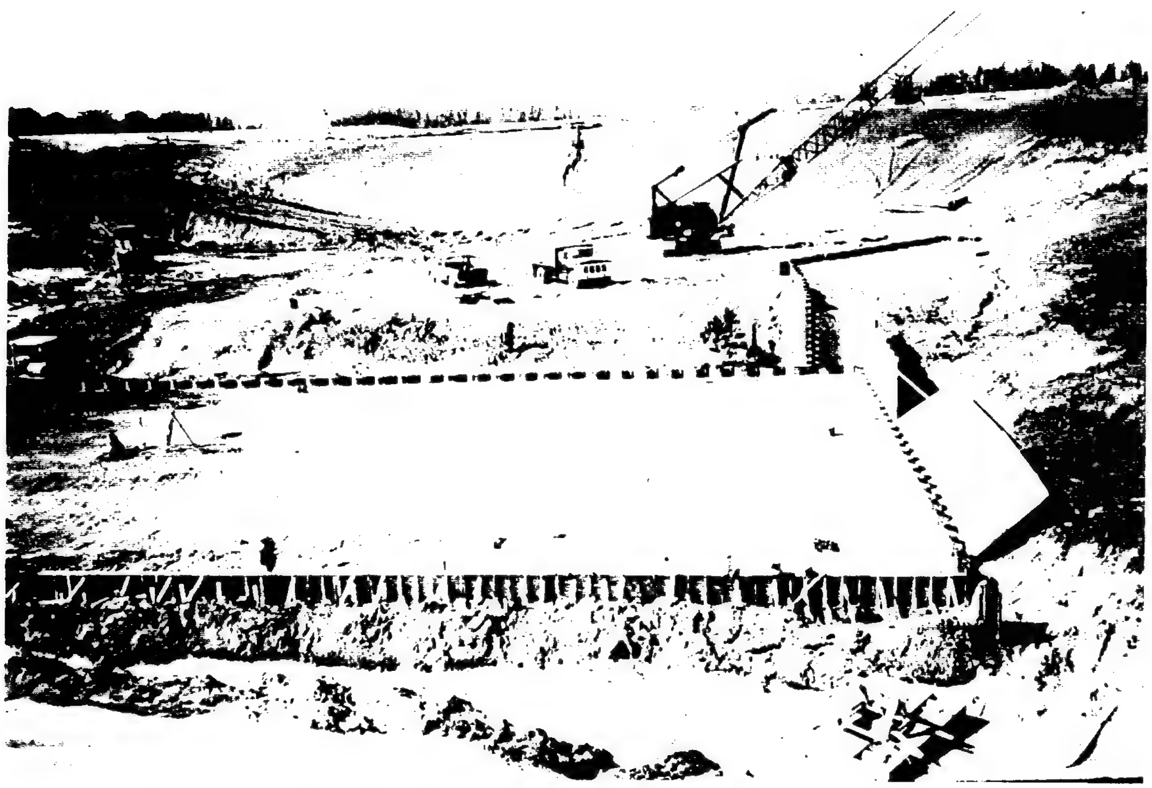
8-04. Repairs to the Floatwell. During the period 26-28 November 1990, repairs were performed at the floatwell located in the outlet channel for the Tensas-Cocodrie Gravity Drainage Structure. During the periodic inspection in August of that year it was discovered that piping of foundation sand was occurring

along the horizontal pipe that connects the floatwell to the channel. Repairs included cleaning the depression, placing 44 cubic yards of concrete sand on the exposed foundation, covering the area with four hundred square yards of engineering fabric, and installing approximately 125 cubic yards of R 90 riprap. In addition, two drain pipes were installed adjacent to the horizontal pipe. Each drain pipe consisted of three feet of 2-inch PVC pipe and three feet of 2-inch #10 slot PVC well screen. No further problems have occurred. For a detailed review of the remedial measures performed see Appendix G of Periodic Inspection Report Number 3, (August 1990).

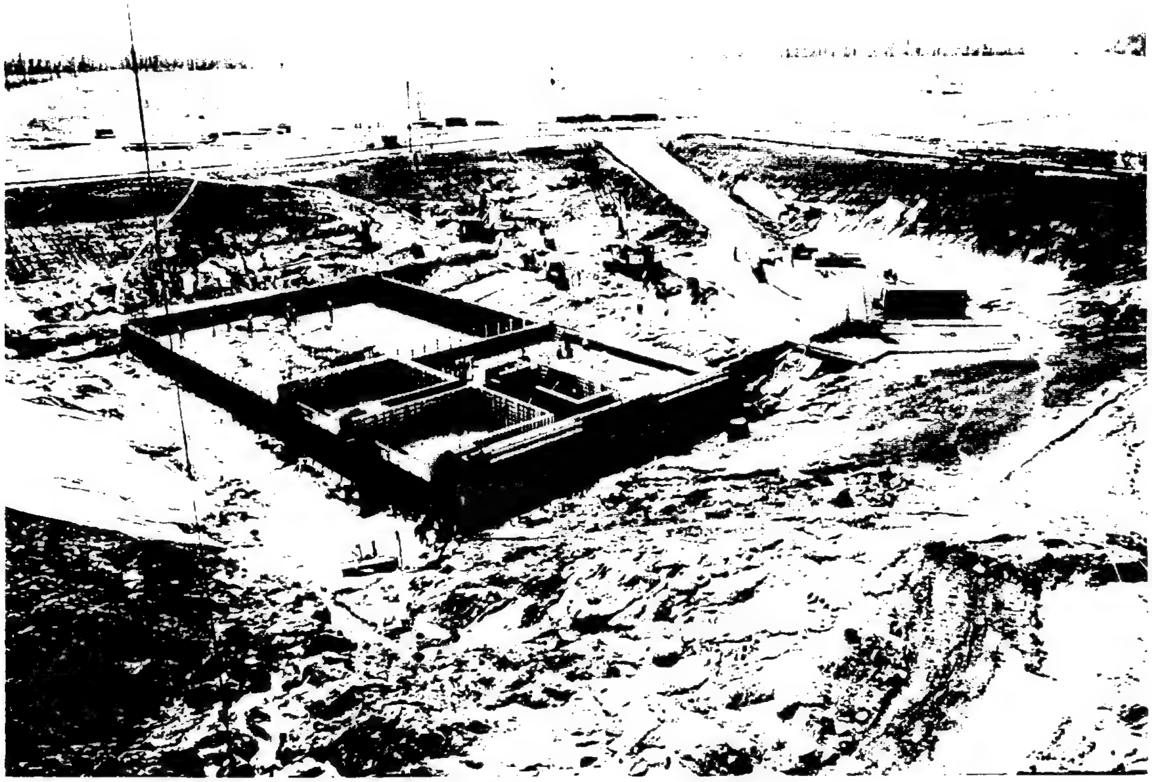
1. Aerial view of completed pumping plant looking east.

2. Aerial view of the completed project looking west.

3. Aerial view of the completed upper weir - looking upstream.

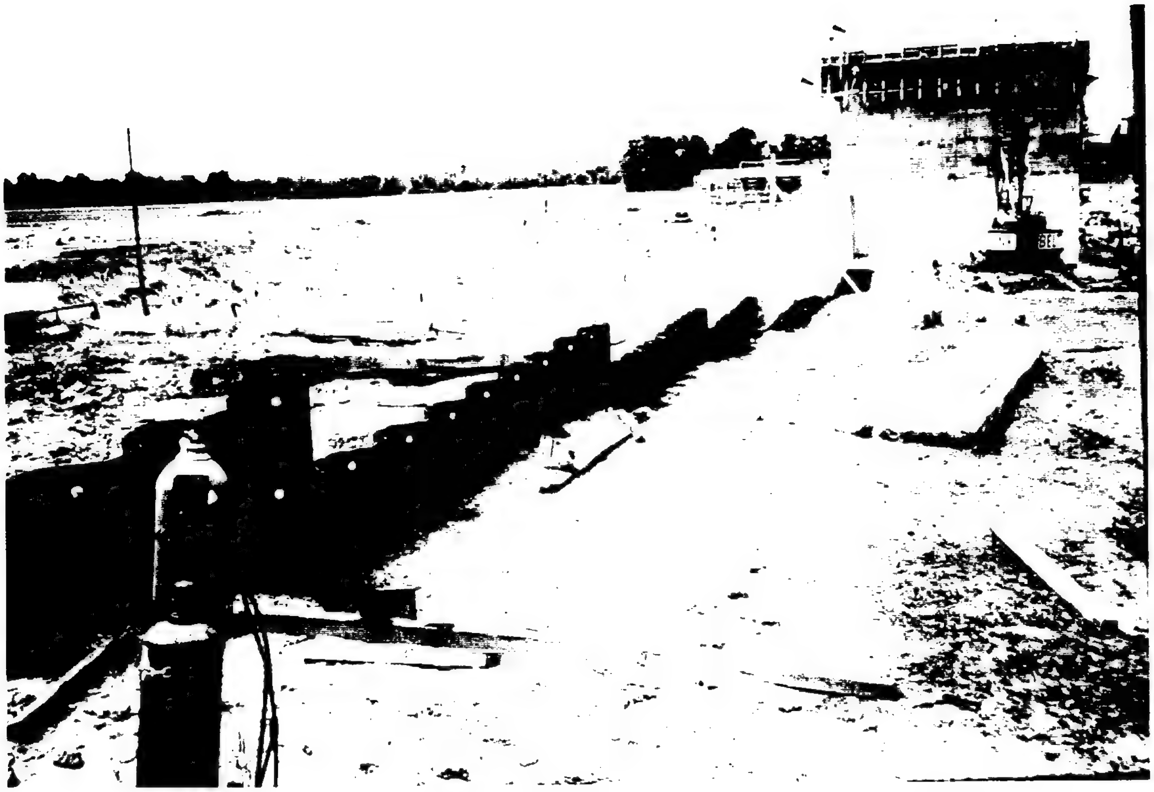


4. Final preparation - pumping plant foundation.

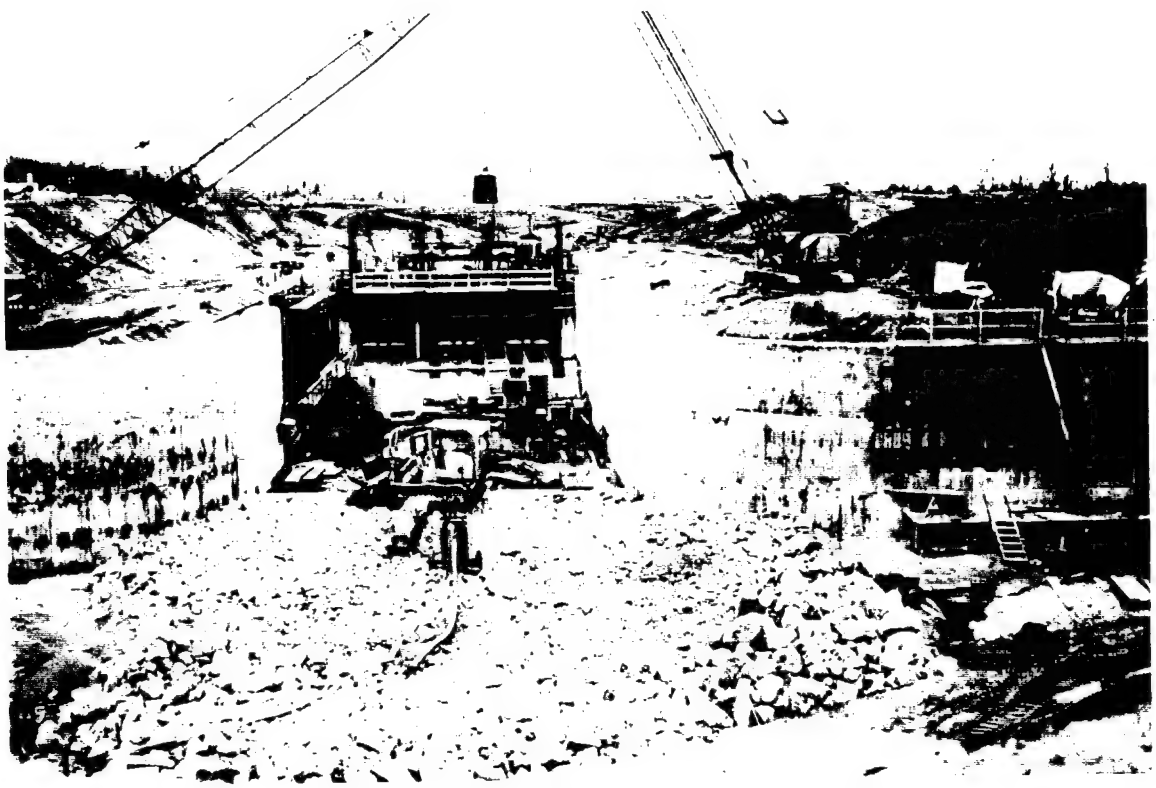


5. Early concrete work - pumping plant.

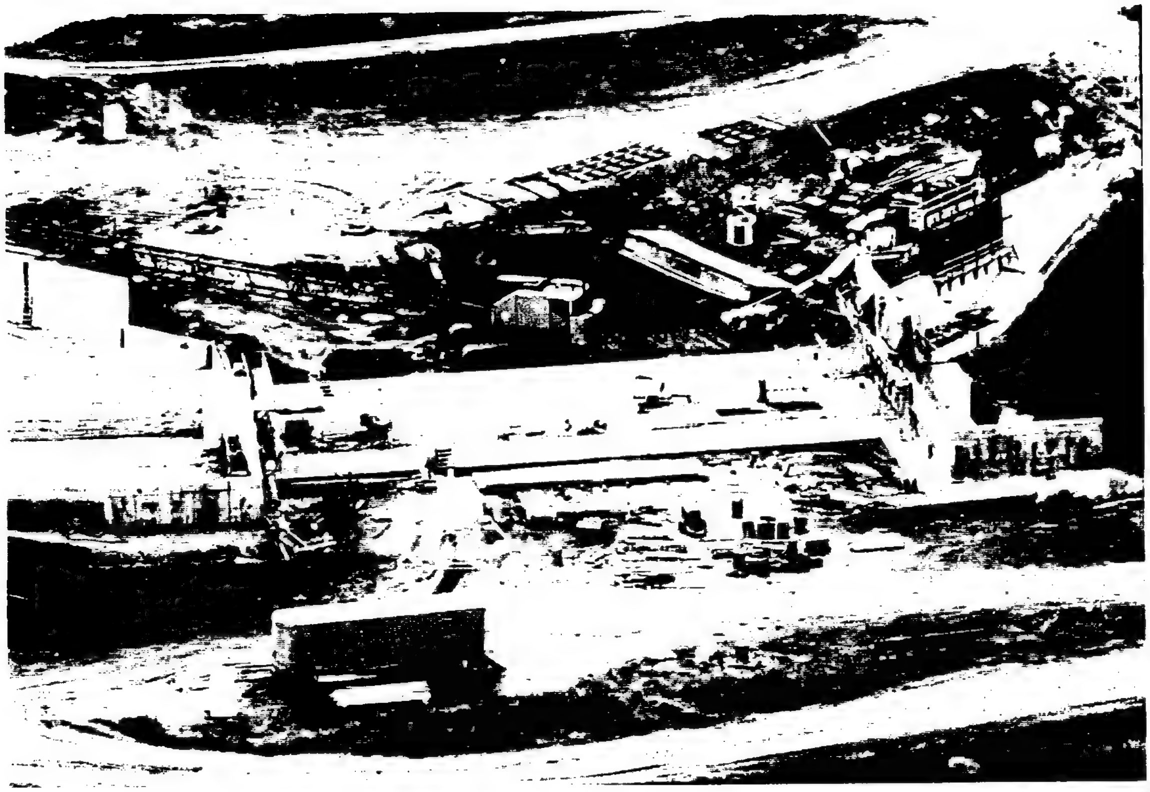
6. Looking southwest at pumping plant. Note top of sheet pile where north floodwall will be constructed.



7. Looking north along south floodwall at pumping plant.

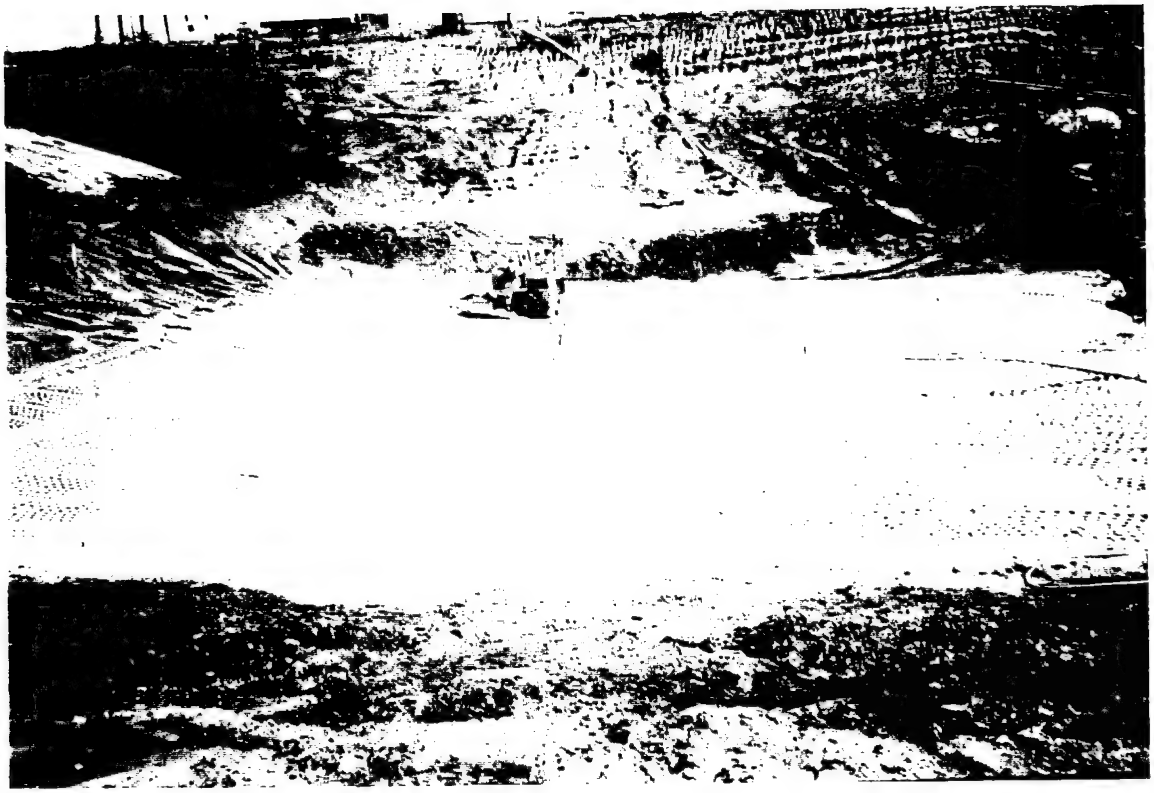


8. Looking upstream at gravity drainage structure outlet channel and stilling basin.



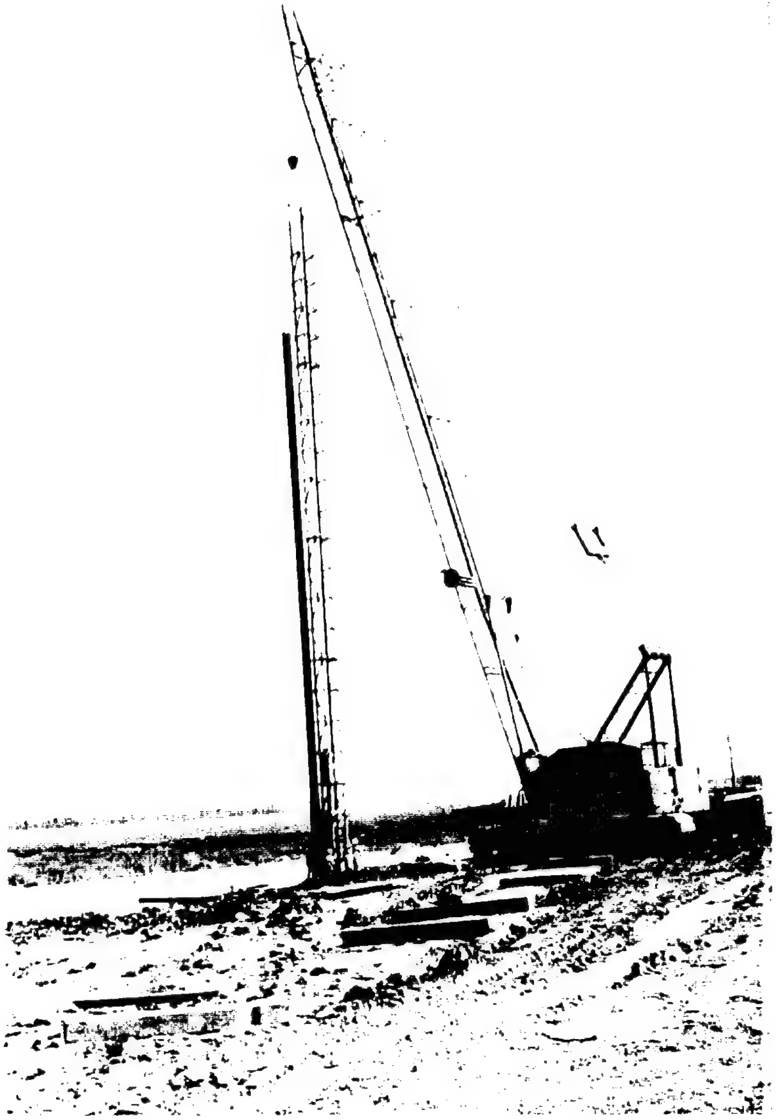
9. Aerial view of the construction of the upper weir - looking downstream.

10. Dewatering well and header pipes - pumping plant.

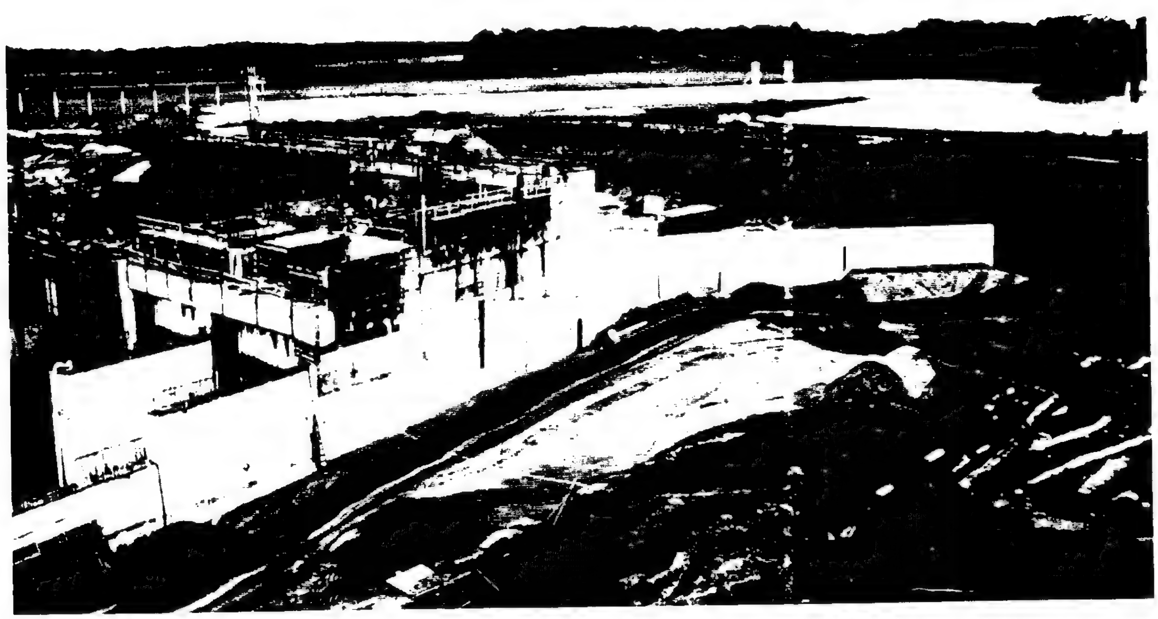


11. Backfill sand placed in the pumping plant foundation area after excavation of unsuitable material.

12. Slide in the upper weir cofferdam.



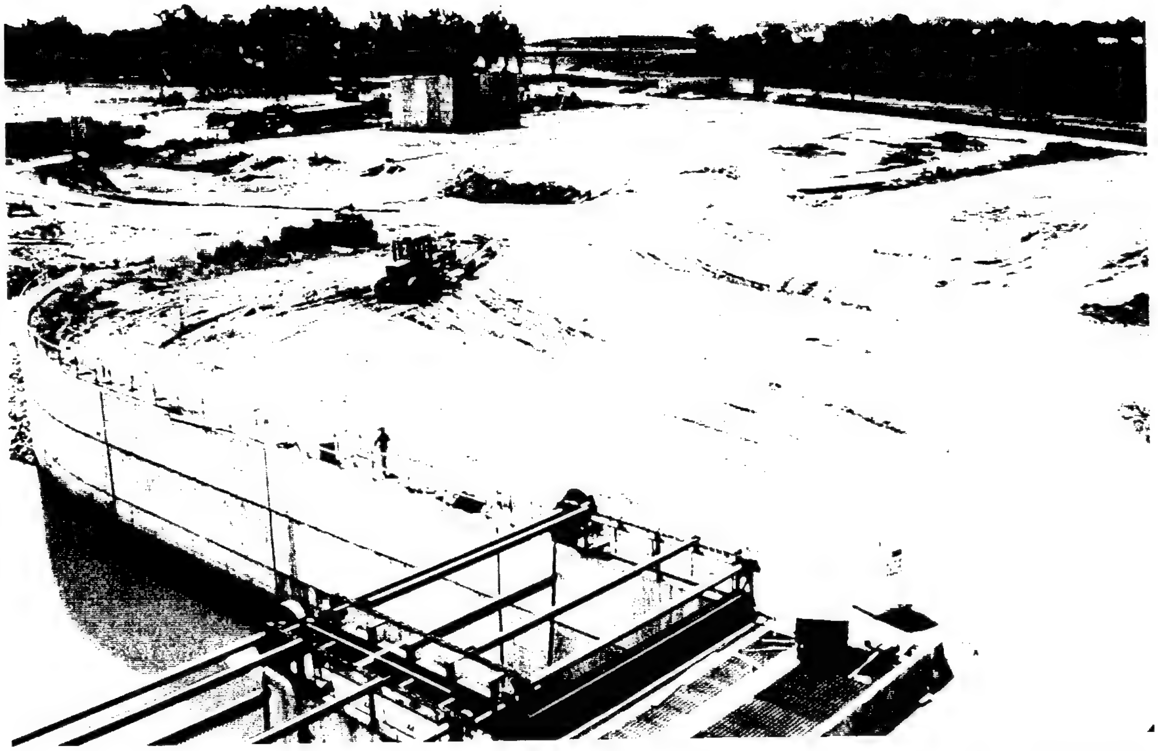
13. Pile driving operation - upper weir.



14. Looking southwest at pumping plant. Note backfilled sand placed adjacent to structure.

15. Looking southeast at pumping plant upstream retaining wall and inlet channel area.

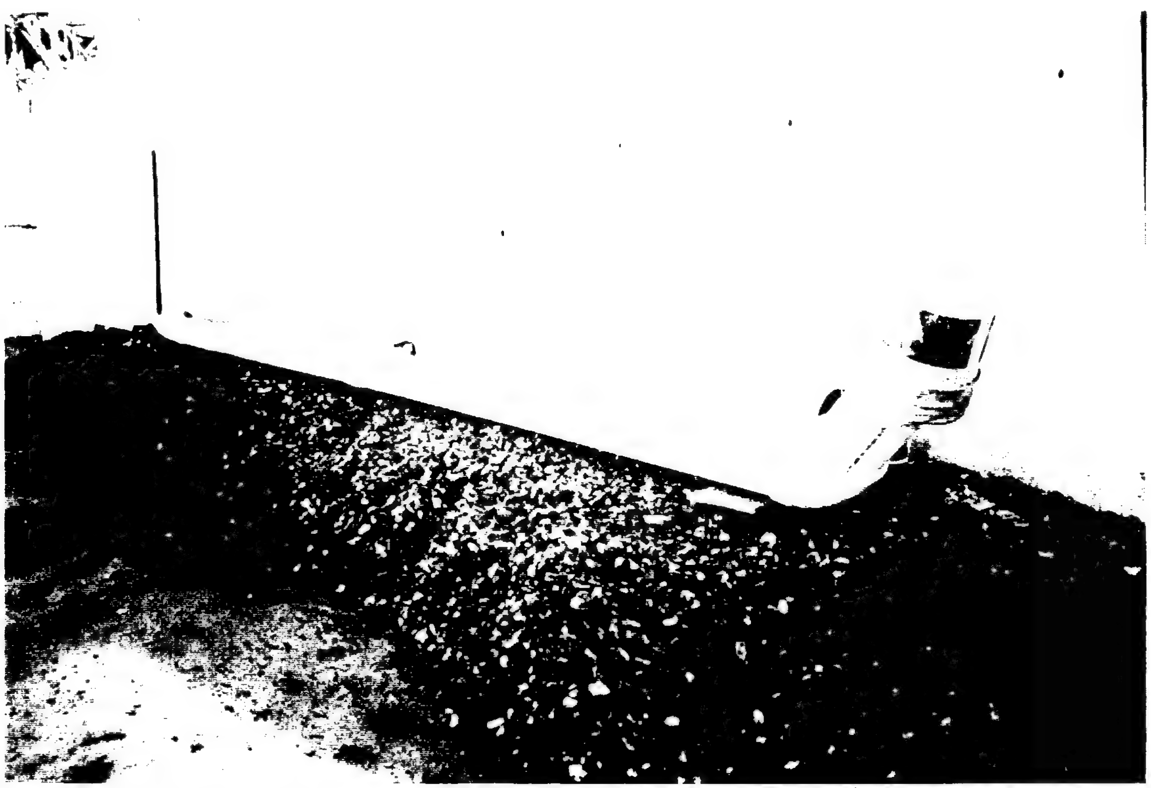
16. Looking southeast at backfilled area northwest of pumping plant.



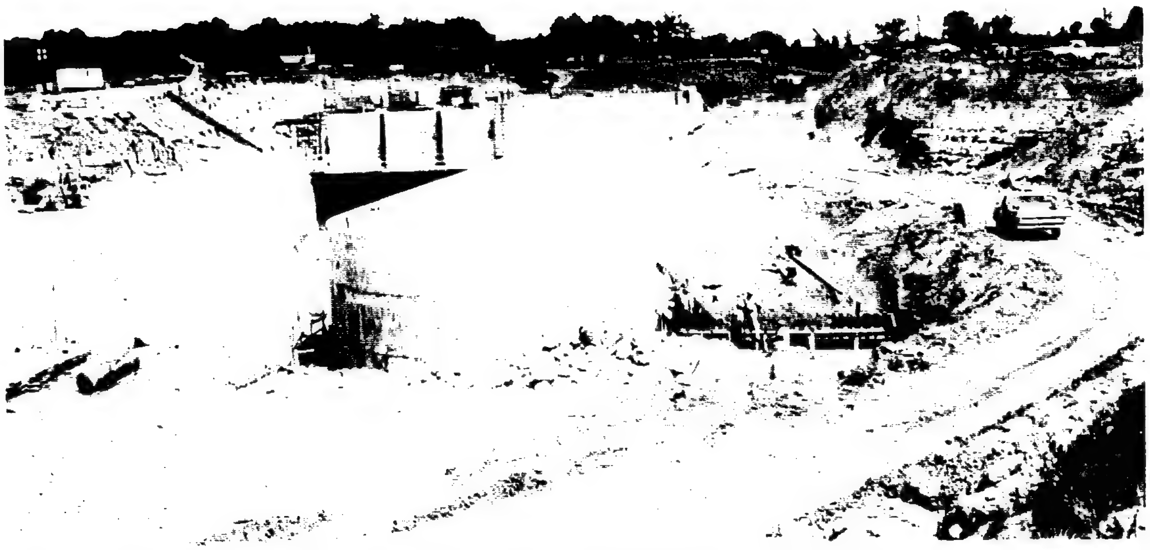
17. Looking southeast at backfilled area adjacent to pumping plant upstream south retaining wall.

18. Looking southwest along the pumping plant north floodwall.

19. Looking south along the pumping plant south floodwall.

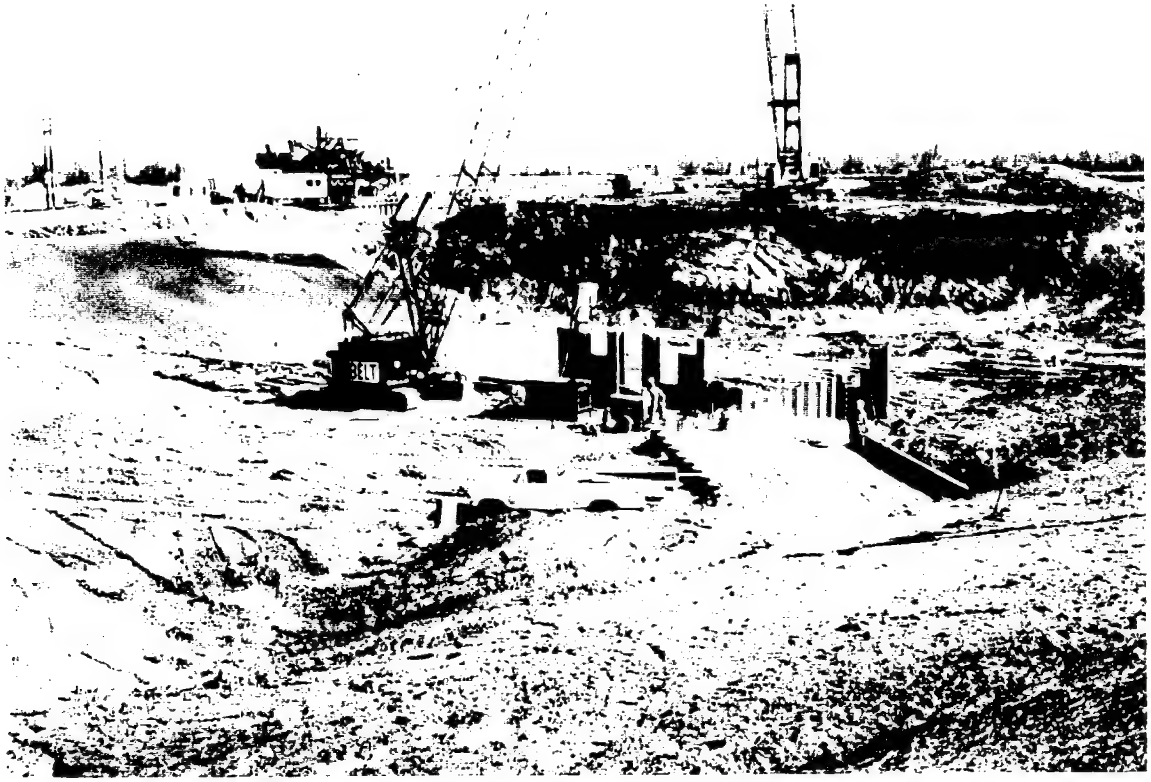


20. Backfill drain system collector pipe on a layer of filter gravel.

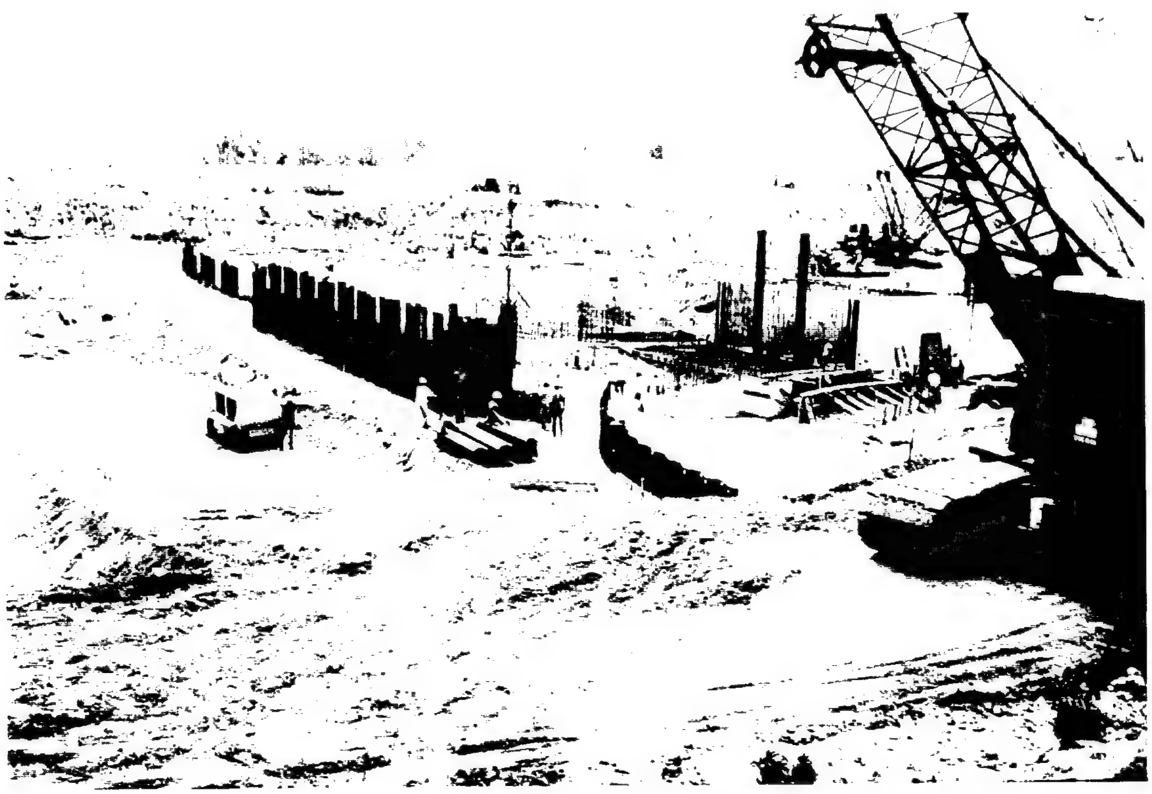


21. Looking east at gravity drainage structure south wing wall.

22. Compacting backfill sand adjacent to the upper weir wing wall.

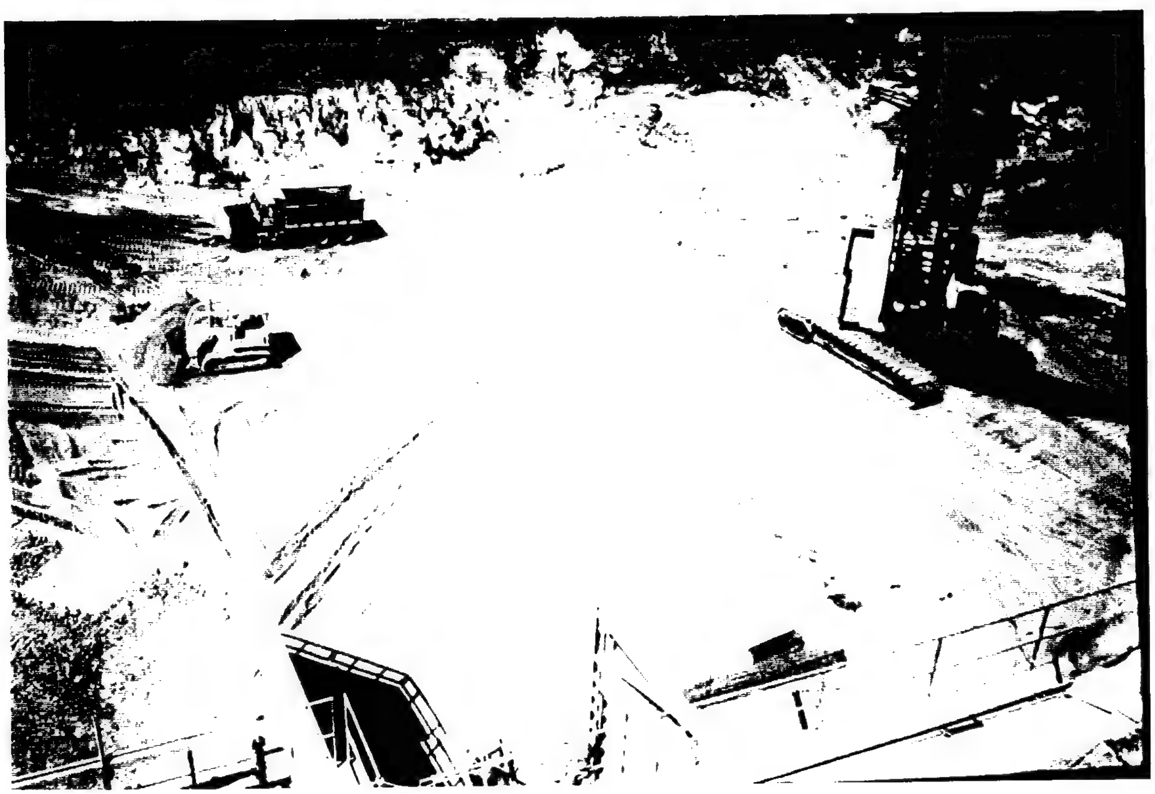


23. Driving sheet pile for the pumping plant.



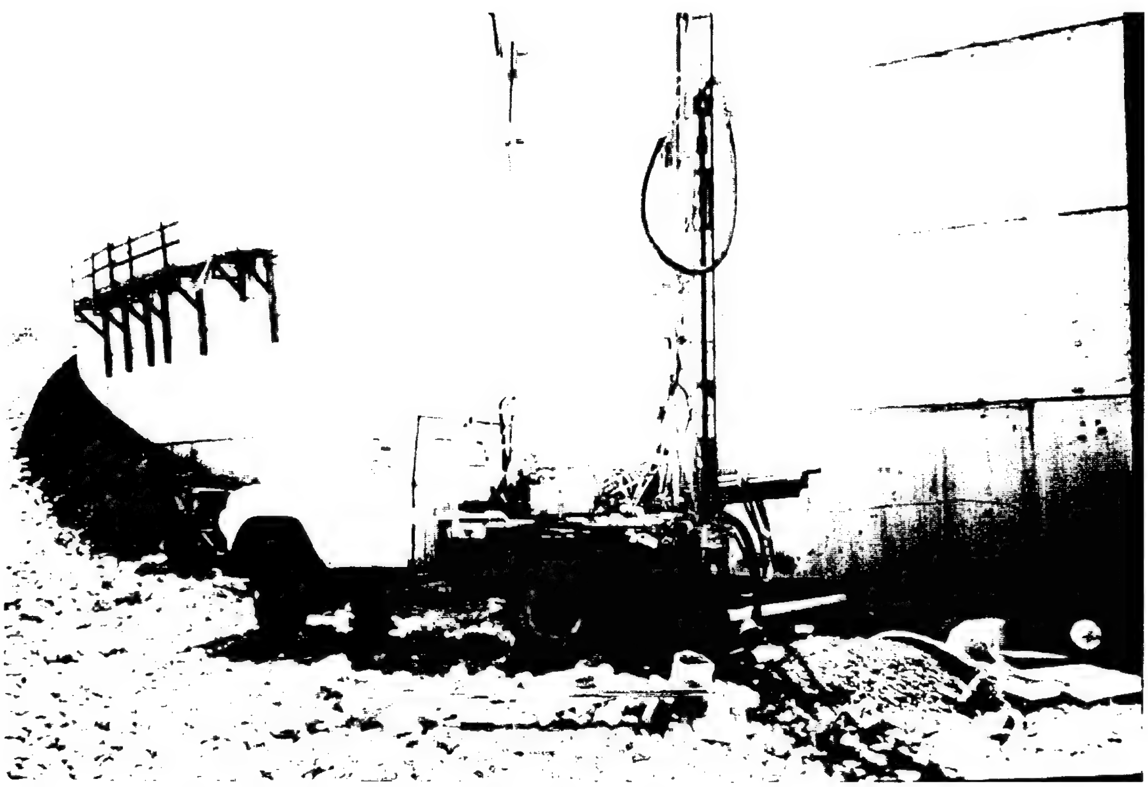
24. Driving sheet pile for the stilling basin endsill and wing walls - drainage structure.

25. Placing channel protection (filter cloth, bedding material, and riprap) in the downstream channel at the pumping plant.

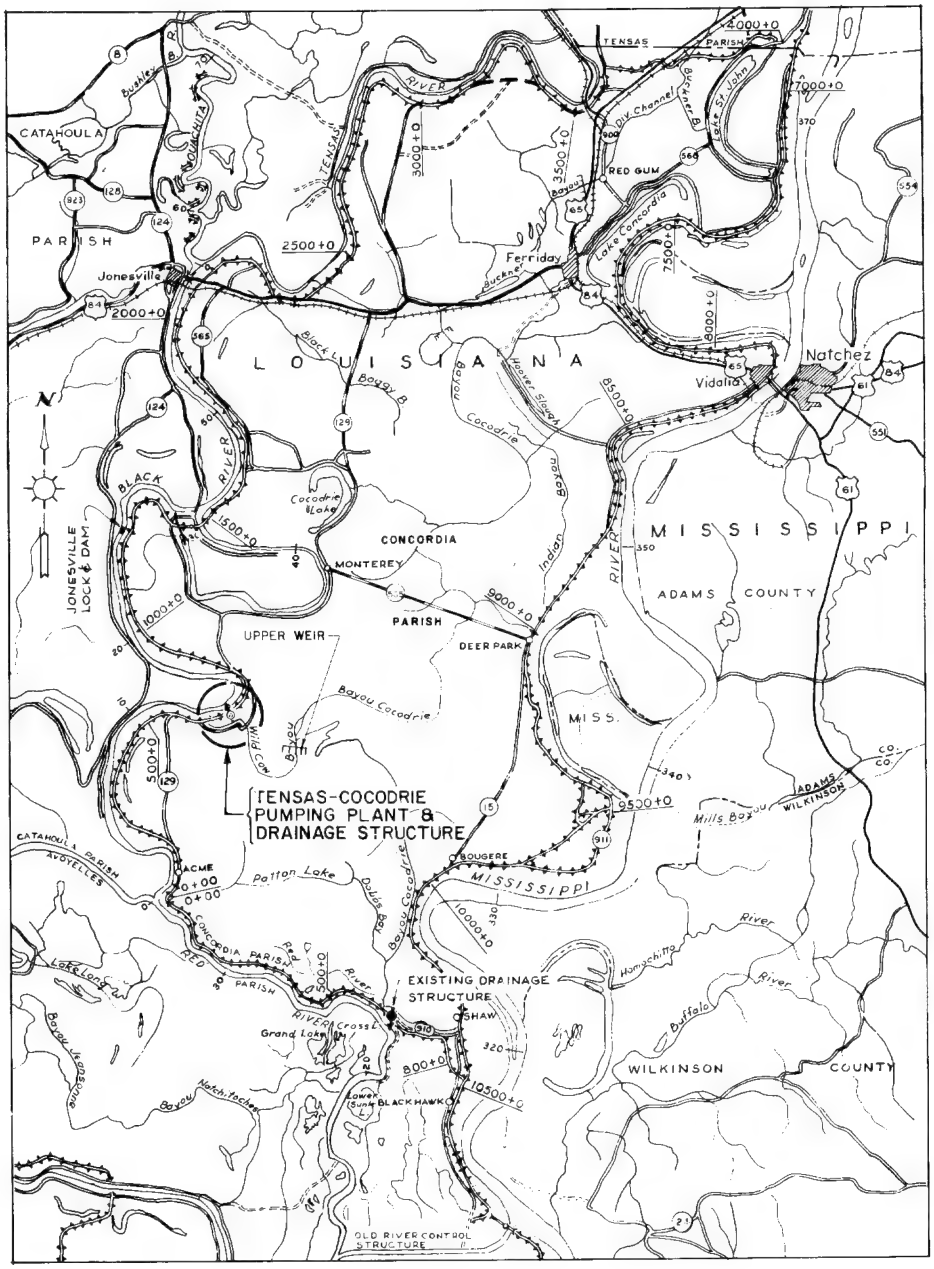


26. Placing bedding material in the upstream channel for the pumping plant.

27. Spreading bedding material on the filter fabric in the downstream channel at the pumping plant.



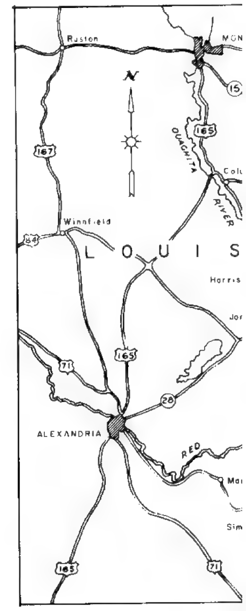
28. Installing permanent piezometer F-7 at the pumping plant.



PROJECT LOCATION MAP

SCALE IN MILES

5 0 5 10



VI(

SC

LOCATION

Bayou

Tensas

Channe

Existi

Weir

ROAD

Heavy Duty

Medium Du

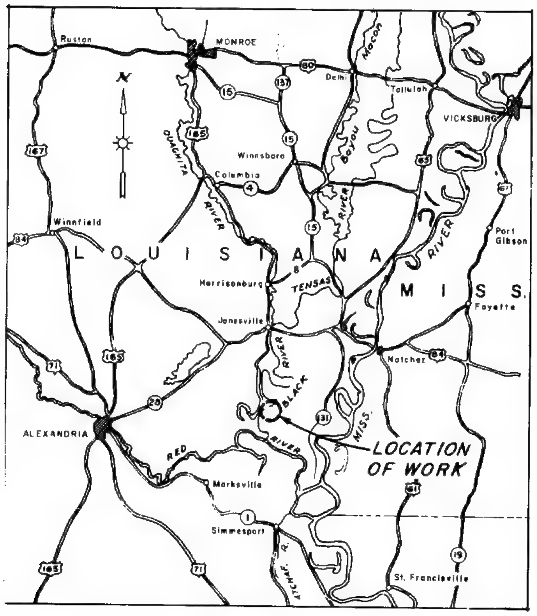
Light Duty

Unimproved

GENER

1. ALL ELEVAT NATIONAL GEODETIC

2. GRID COORD THE BLACK RIVER B LAMBERT COORDINA



VICINITY MAP

SCALE IN MILES

10 0 10 20 30

LOCATION MAP LEGEND

Bayou Cocodrie Drainage Structure
Tensas - Cocodrie Pumping Plant
Channel Improvement
Existing Levee
Weir

ROAD CLASSIFICATION

Heavy Duty
Medium Duty
Light Duty
Unimproved Dirt
State Route
U. S. Route

GENERAL NOTES

1. *ALL ELEVATIONS ARE IN FEET AND REFER TO NATIONAL GEODETIC VERTICAL DATUM. (N.G.V.D.)*

2. *GRID COORDINATE SYSTEM SHOWN COINCIDES WITH THE BLACK RIVER BASELINE COORDINATES, (MISSISSIPPI LAMBERT COORDINATE SYSTEM).*

2

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

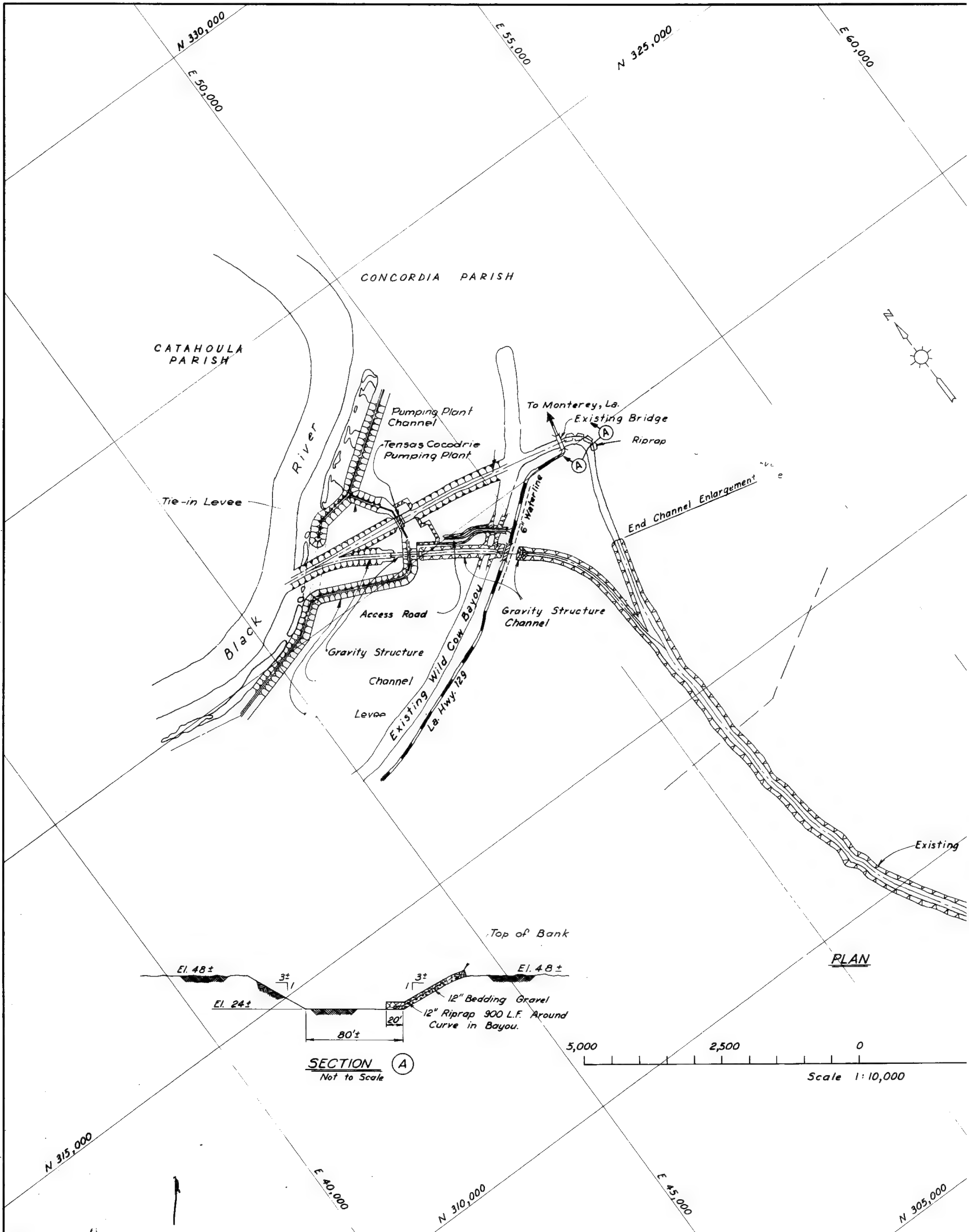
TENSAS-COCODRIE PUMPING PLANT
AND DRAINAGE STRUCTURE

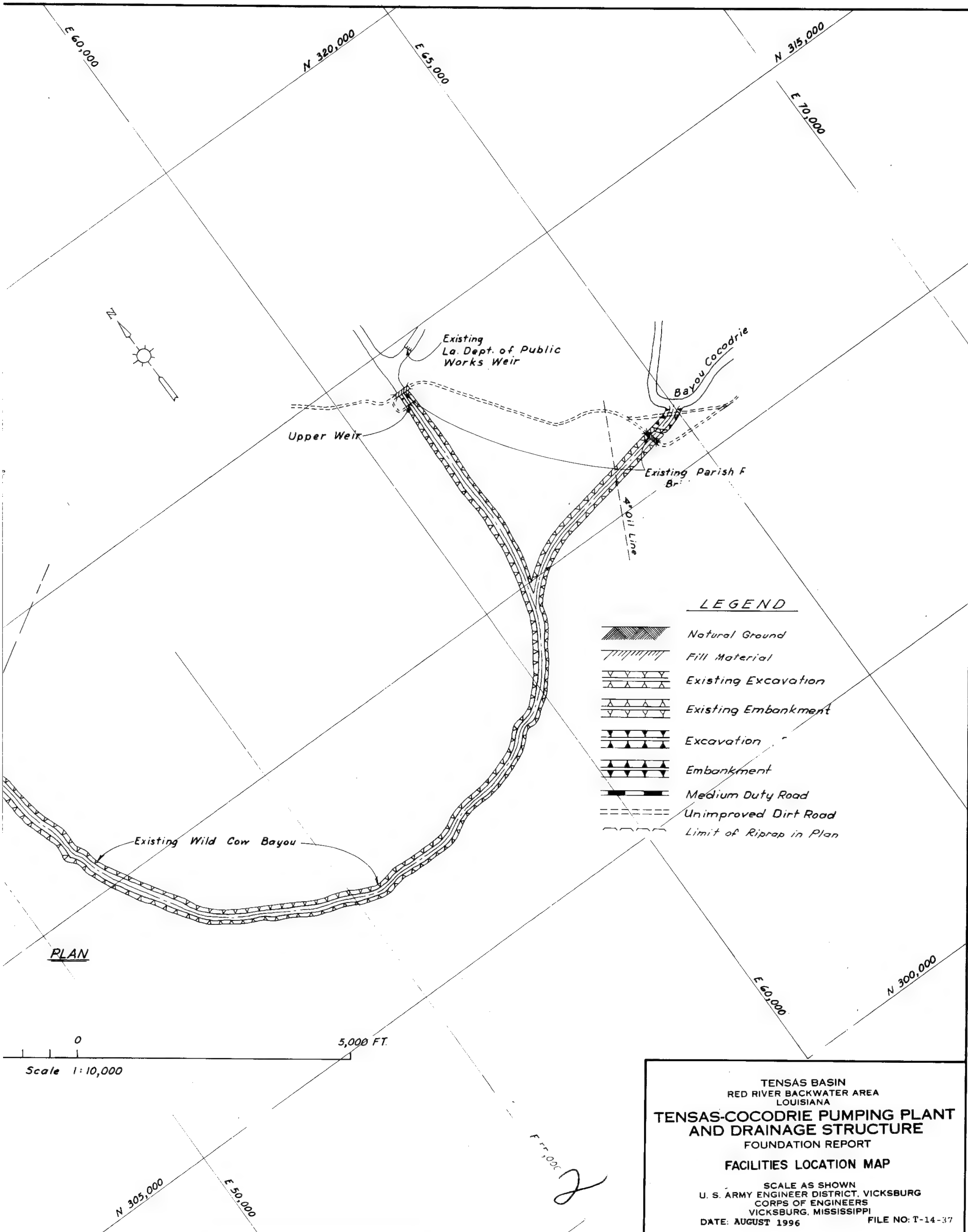
FOUNDATION REPORT

PROJECT LOCATION MAP

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: 1-14-37


N 330,000
E 55,000
N 325,000
E 60,000
E 50,000
CONCORDIA PARISH
CATAHOULA PARISH
Pumping Plant Channel
Tensas Cocodrie Pumping Plant
To Monterey, La.
Existing Bridge
A
Riprap
River
Tie-in Levee
End Channel Enlargement
6" Waterline
Access Road
Gravity Structure Channel
Black
Gravity Structure
Channel
Levee
Existing Wild Cow Bayou
La. Hwy. 129
Existing
Top of Bank
El. 48 ±
3± 1
El. 24±
20'
80'±
12" Bedding Gravel
12" Riprap 900 L.F. Around Curve in Bayou.
SECTION A
Not to Scale
PLAN
5,000
2,500
0
Scale 1:10,000
N 315,000
E 40,000
N 310,000
E 45,000
N 305,000



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

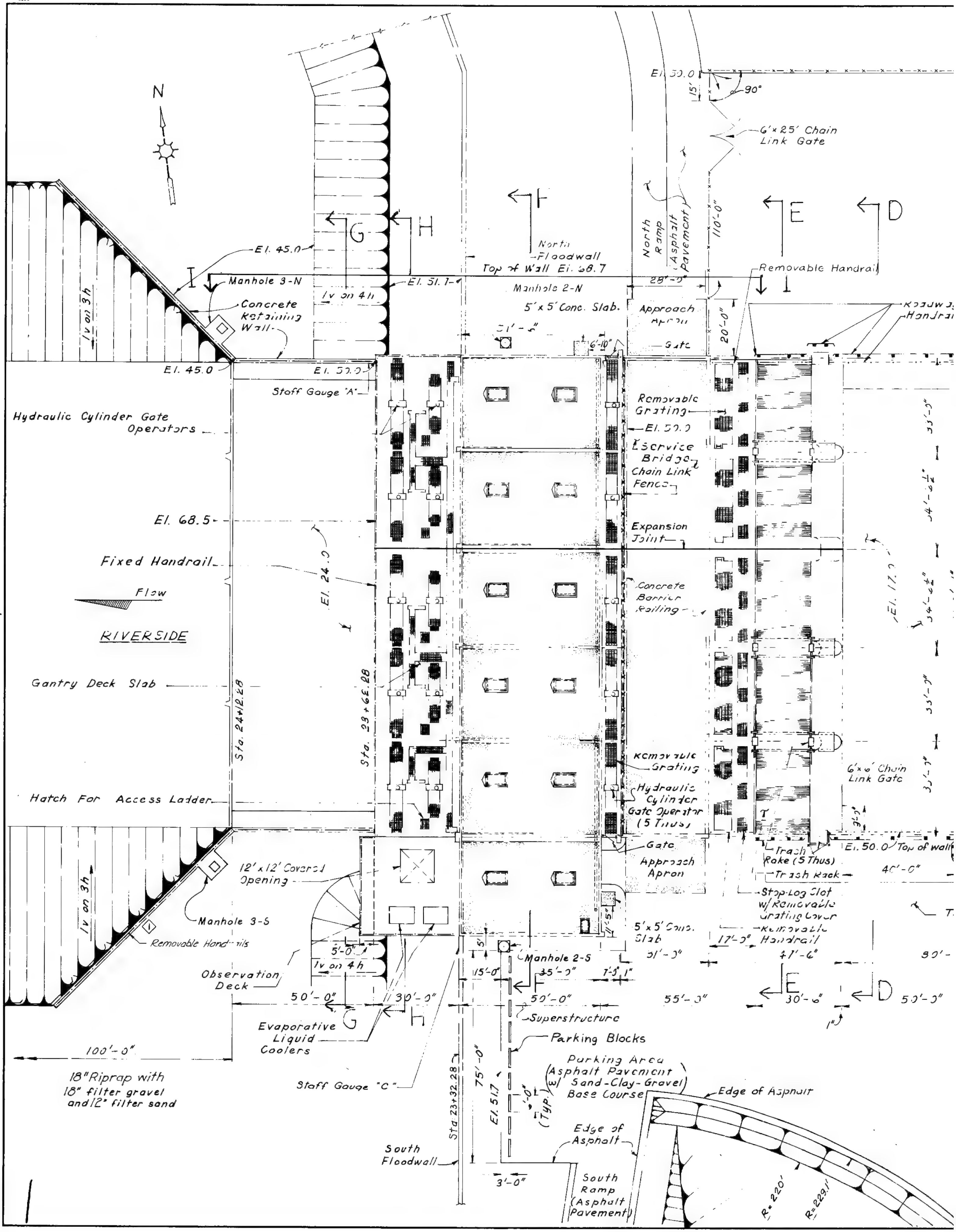
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

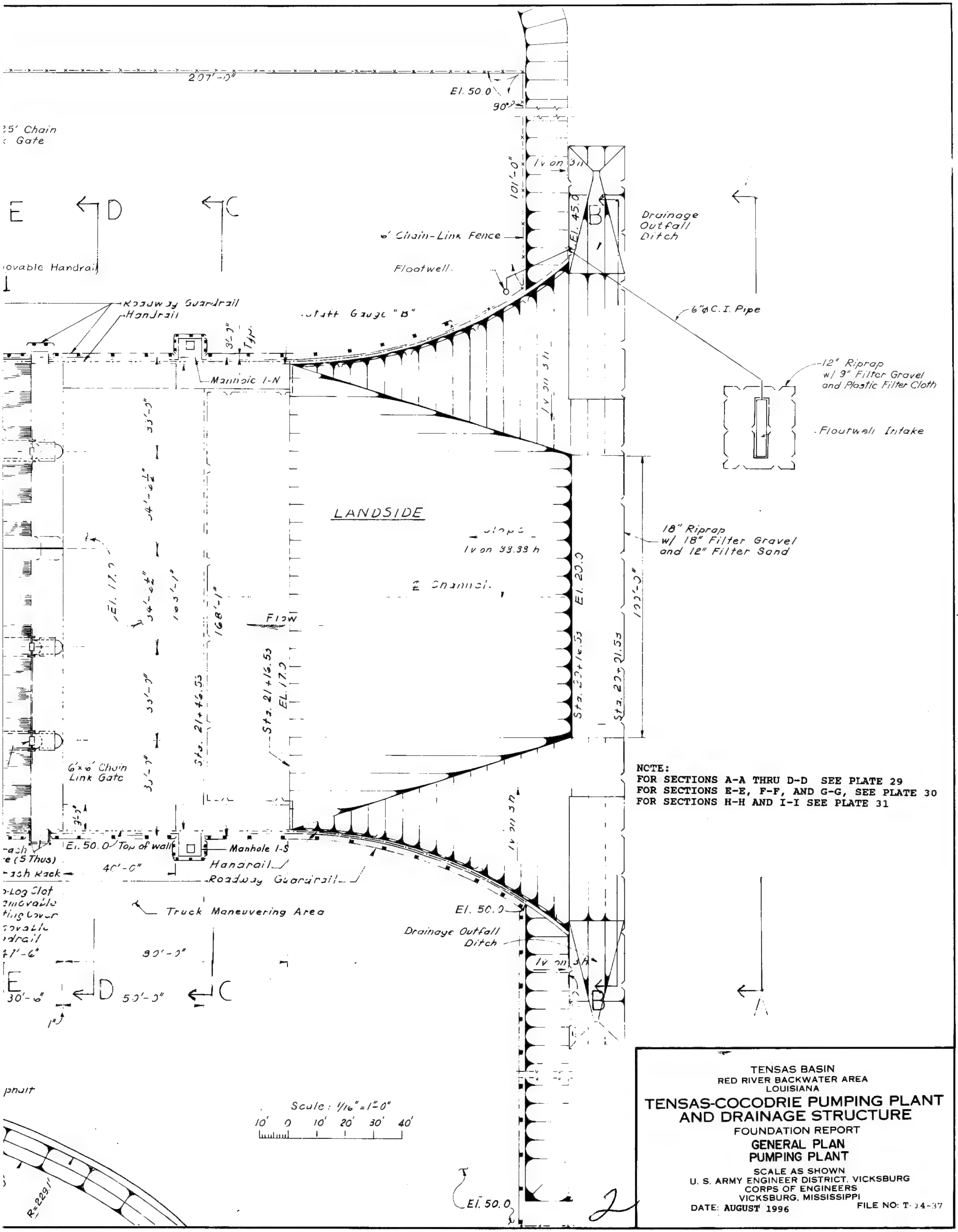
FACILITIES LOCATION MAP

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



N
El. 45.0
I
Manhole 3-N
1v on 3h
Concrete Retaining Wall
G
H
1v on 4h
El. 51.7
F
North Floodwall
Top of Wall El. 68.7
Manhole 2-N
5'x 5' Conc. Slab.
North Ramp (Asphalt Pavement)
28'-0"
110'-0"
20'-0"
Approach Apron
Gate
6'-10"
El. 50.0
15'
90°
6'x 25' Chain Link Gate
E
D
Removable Handrail
Roadway Handrail
El. 45.0
Staff Gouge "A"
Hydraulic Cylinder Gate Operators
El. 68.5
Fixed Handrail
Flow
RIVERSIDE
Gantry Deck Slab
Hatch For Access Ladder
Sta. 24+12.28
Sta. 23+66.28
El. 24.0
Removable Grating
El. 50.0
Service Bridge
Chain Link Fence
Expansion Joint
Concrete Barrier Railing
Removable Grating
Hydraulic Cylinder Gate Operator (5 Thus)
Gate
Approach Apron
El. 17.0
6'x 6' Chain Link Gate
El. 50.0
Top of wall
Trash Rake (5 Thus)
Trash Rack
40'-0"
Stop-Log Slot w/ Removable Grating Cover
Removable Handrail
17'-0"
47'-6"
12'x 12' Covered Opening
Manhole 3-S
Removable Handrails
1v on 3h
5'-0"
1v on 4h
Observation Deck
50'-0"
30'-0"
Evaporative Liquid Coolers
100'-0"
18" Riprap with 18" filter gravel and 12" filter sand
Staff Gouge "C"
Manhole 2-S
15'-0"
35'-0"
50'-0"
55'-0"
30'-6"
50'-0"
5'x 5' Conc. Slab
Superstructure
Parking Blocks
Parking Area (Asphalt Pavement w/ Sand-Clay-Gravel Base Course)
Edge of Asphalt
Edge of Asphalt
75'-0"
El. 51.7
Sta. 23+32.28
South Floodwall
3'-0"
South Ramp (Asphalt Pavement)
R=220'
R=229.1'



NOTE:
FOR SECTIONS A-A THRU D-D SEE PLATE 29
FOR SECTIONS E-E, F-F, AND G-G, SEE PLATE 30
FOR SECTIONS H-H AND I-I SEE PLATE 31

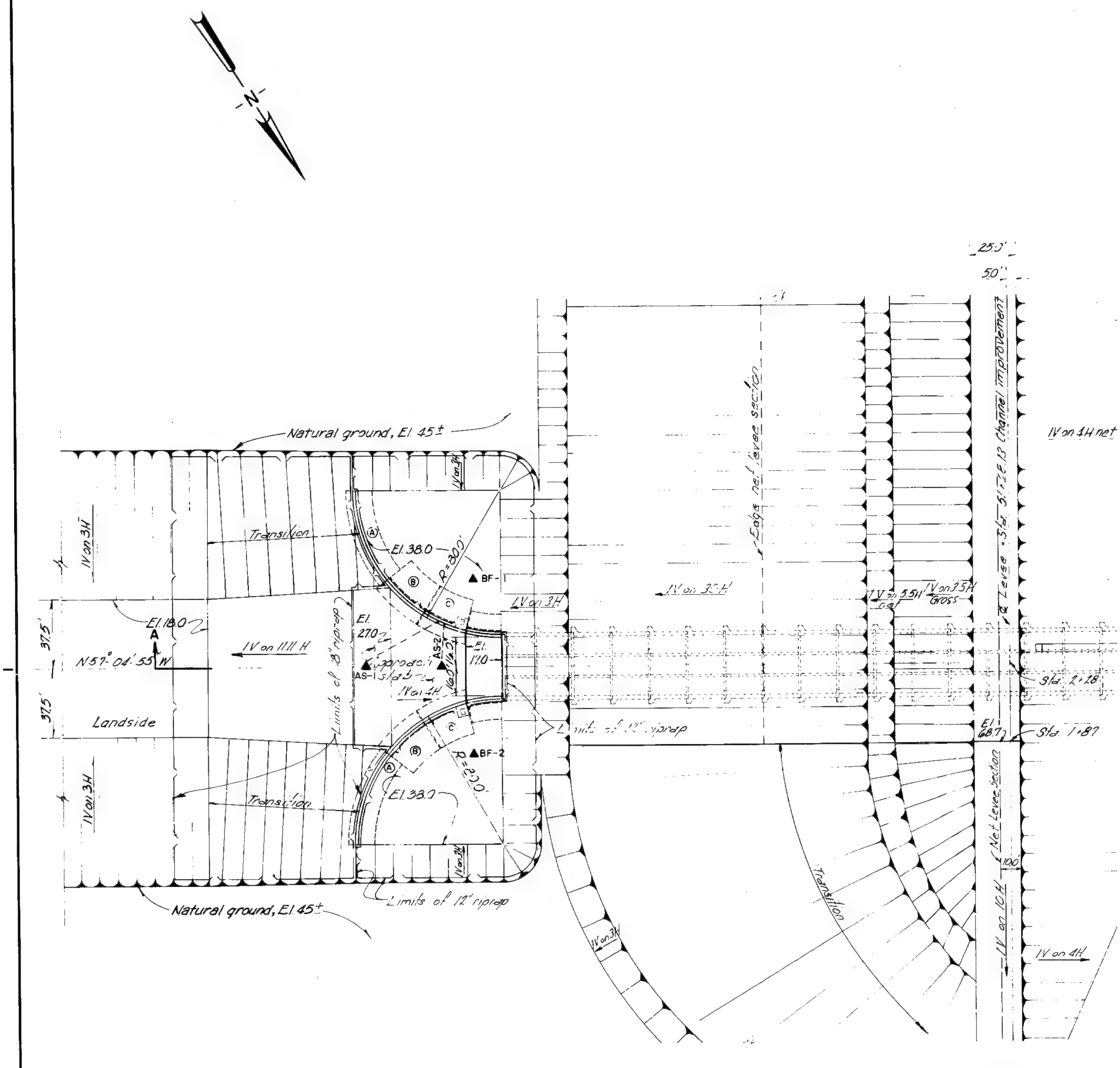
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

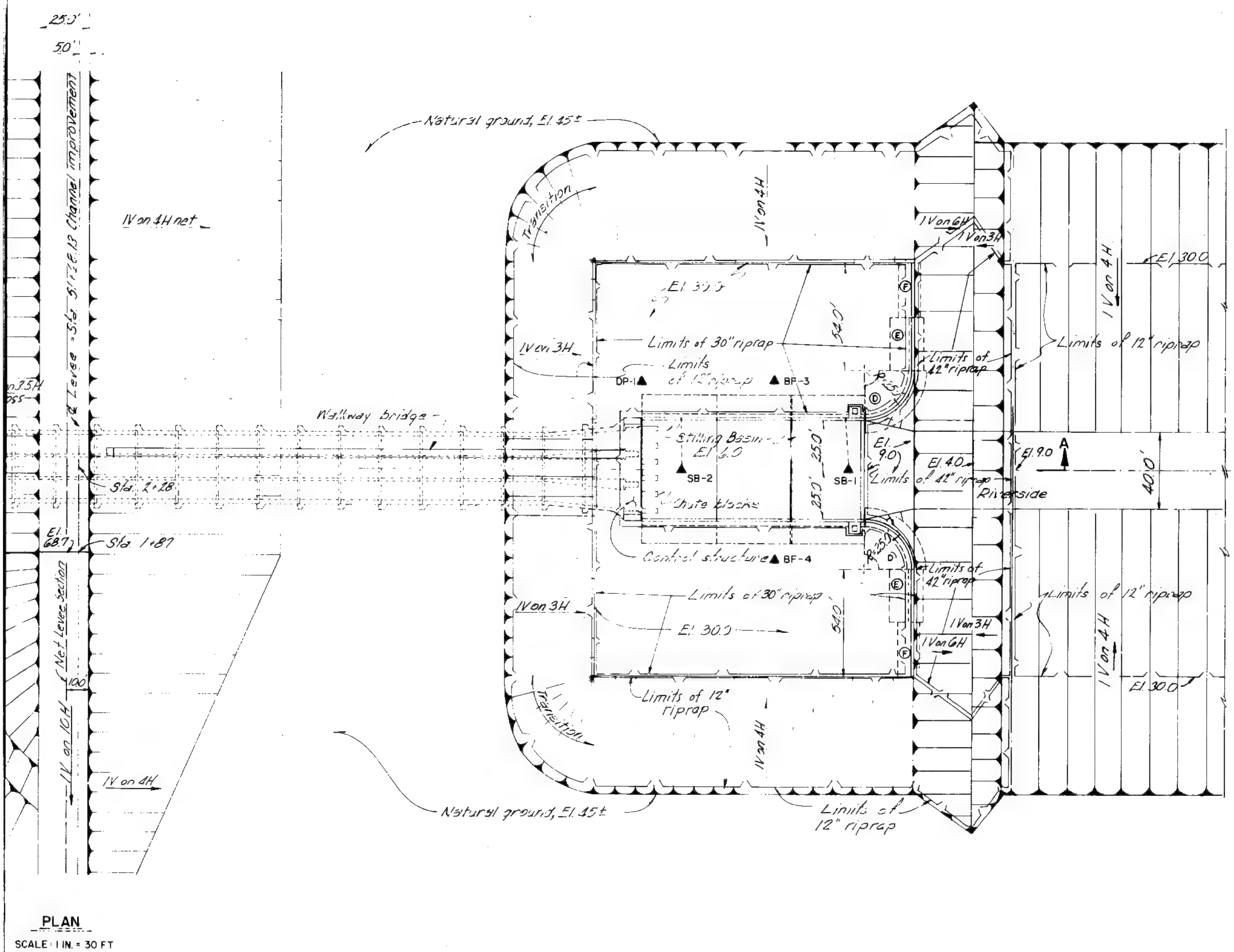
FOUNDATION REPORT

GENERAL PLAN
PUMPING PLANT

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996
FILE NO: T-34-37



PLAN
SCALE: 1 IN. = 30 FT



PLAN
SCALE: 1 IN. = 30 FT

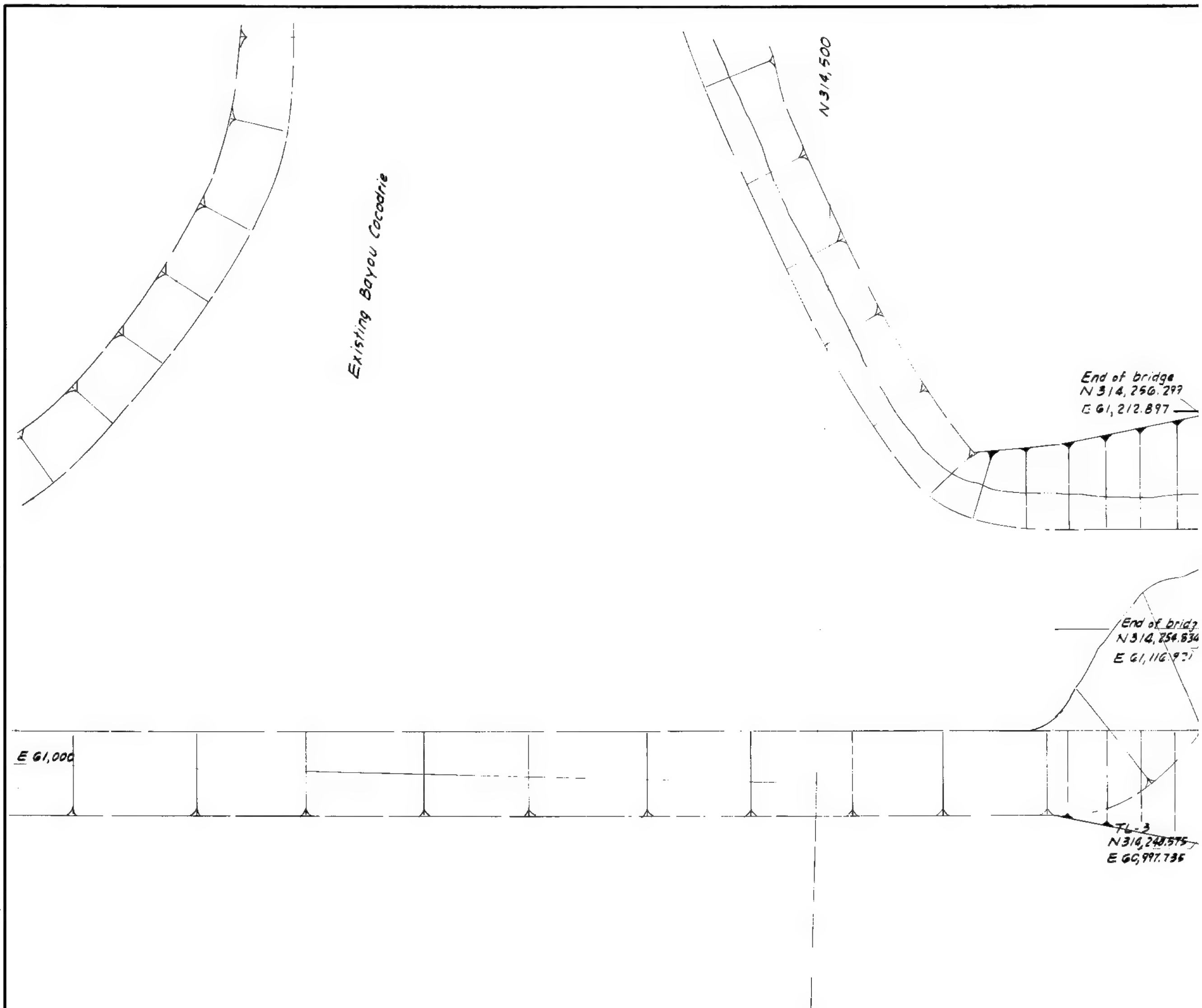
SCALE: 1 IN. = 30 FT
30 15 0 30 60 90 FT

LEGEND
Ⓐ Monolith designation
▲ BF-2 Piezometer designation and location

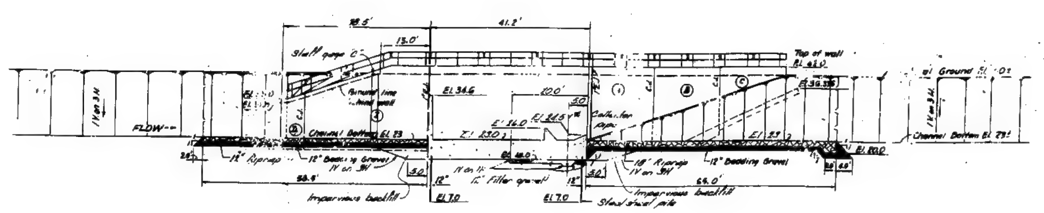
NOTE:
FOR GEOLOGICAL SECTION A-A SEE PLATE 24
FOR PIEZOMETER DETAILS SEE PLATE 38

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA
TENSAS-COCODRIE PUMPING PLANT
AND DRAINAGE STRUCTURE
FOUNDATION REPORT
GRAVITY DRAINAGE STRUCTURE PLAN
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

2



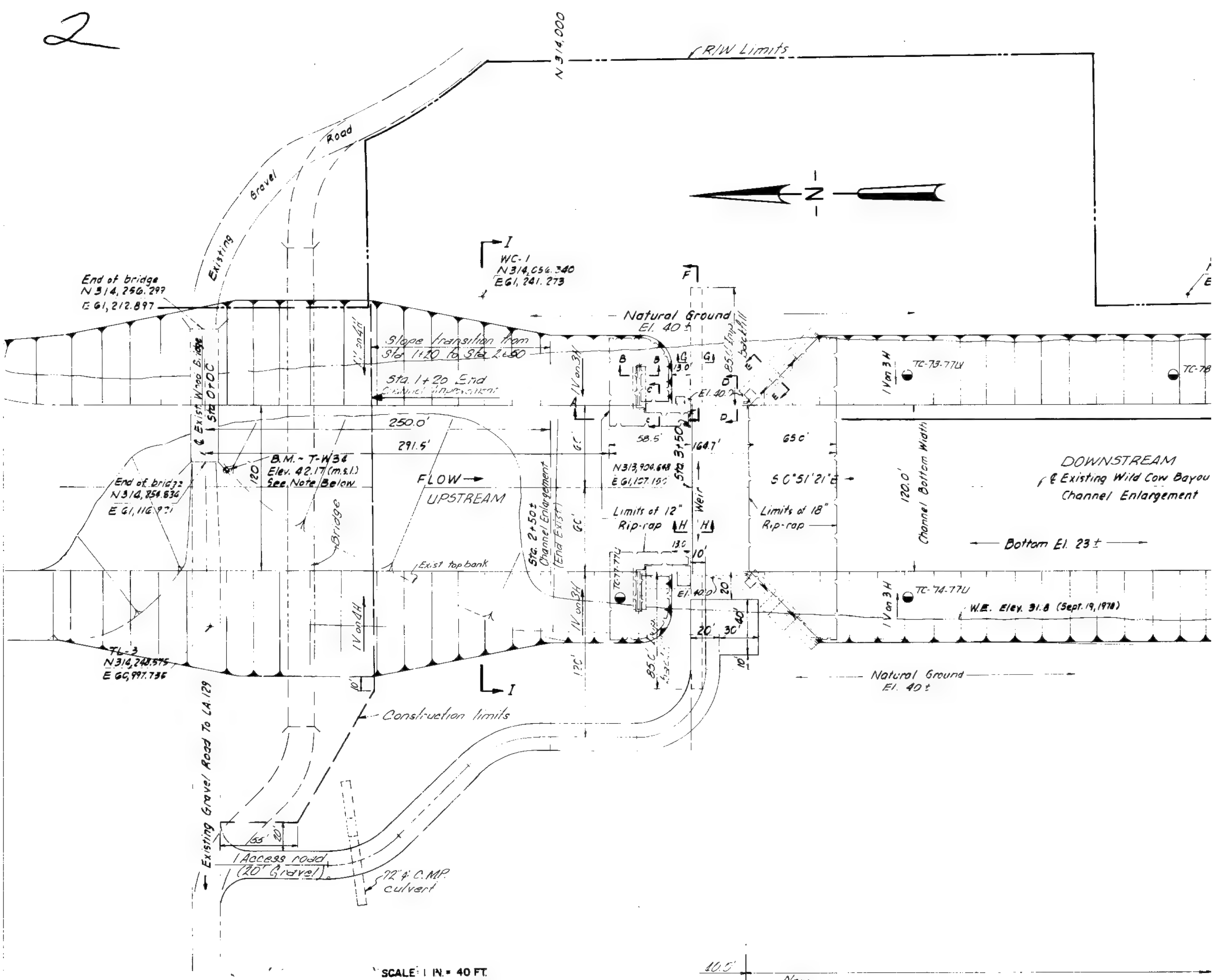
UPPER WEIR - S



SECTION A-A

SCALE 1 IN = 10 FT

2



SCALE: 1 IN. = 40 FT.

40 20 0 40 80 120 FT.

10.5' New

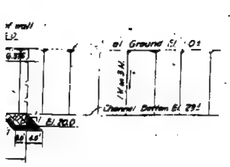
SCALE: 1 IN. = 5 FT.

5 0 5 10 15 FT

SCALE: 1 IN. = 20 FT.

20 10 0 20 40 60 FT.

UPPER WEIR - SITE PLAN



BENCH MARK

MARK	DESCRIPTION	ELEV. (M.S.L.)
T-W34	Top of anchor bolt on extreme southwest corner of wooden bridge crossing Wild Cow Bayou at gravel road, located at Junction of Wild Cow Bayou and Bayou Cocodrie. (Painted yellow)	42.17

R/W Limits

LEGEND

TC-74-77U — Boring Locations from which undisturbed samples were taken and designations

BORINGS SHOWN ON PLATE 20

NOTE:
FOR SECTIONS B-B THRU H-H SEE PLATE 37

FOR GEOLOGICAL SECTION A-A SEE PLATE 23

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

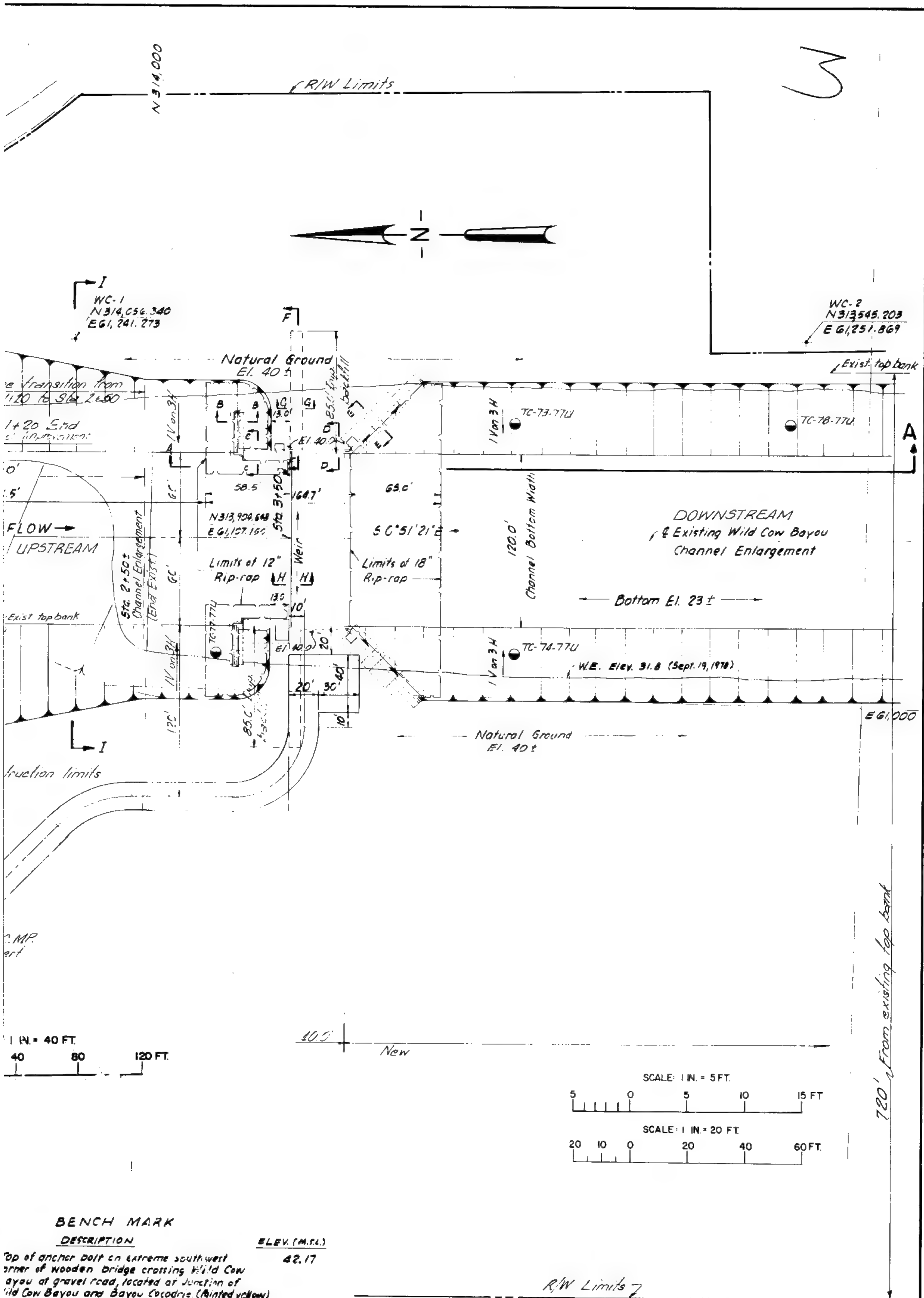
TENSAS-COCODRIE PUMPING
AND DRAINAGE STRUCT

FOUNDATION REPORT

UPPER WEIR SITE PLAN AND SE

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKS
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE

2



BENCH MARK

DESCRIPTION	ELEV. (M.S.L.)
Top of anchor bolt on extreme southwest corner of wooden bridge crossing Wild Cow Bayou at gravel road, located at junction of Wild Cow Bayou and Bayou Cocodrie. (Painted yellow)	42.17

LEGEND

TC-74-77U — Boring Locations from which undisturbed samples were taken and designations

BORINGS SHOWN ON PLATE 20

NOTE:
FOR SECTIONS B-B THRU H-H SEE PLATE 37
FOR GEOLOGICAL SECTION A-A SEE PLATE 23

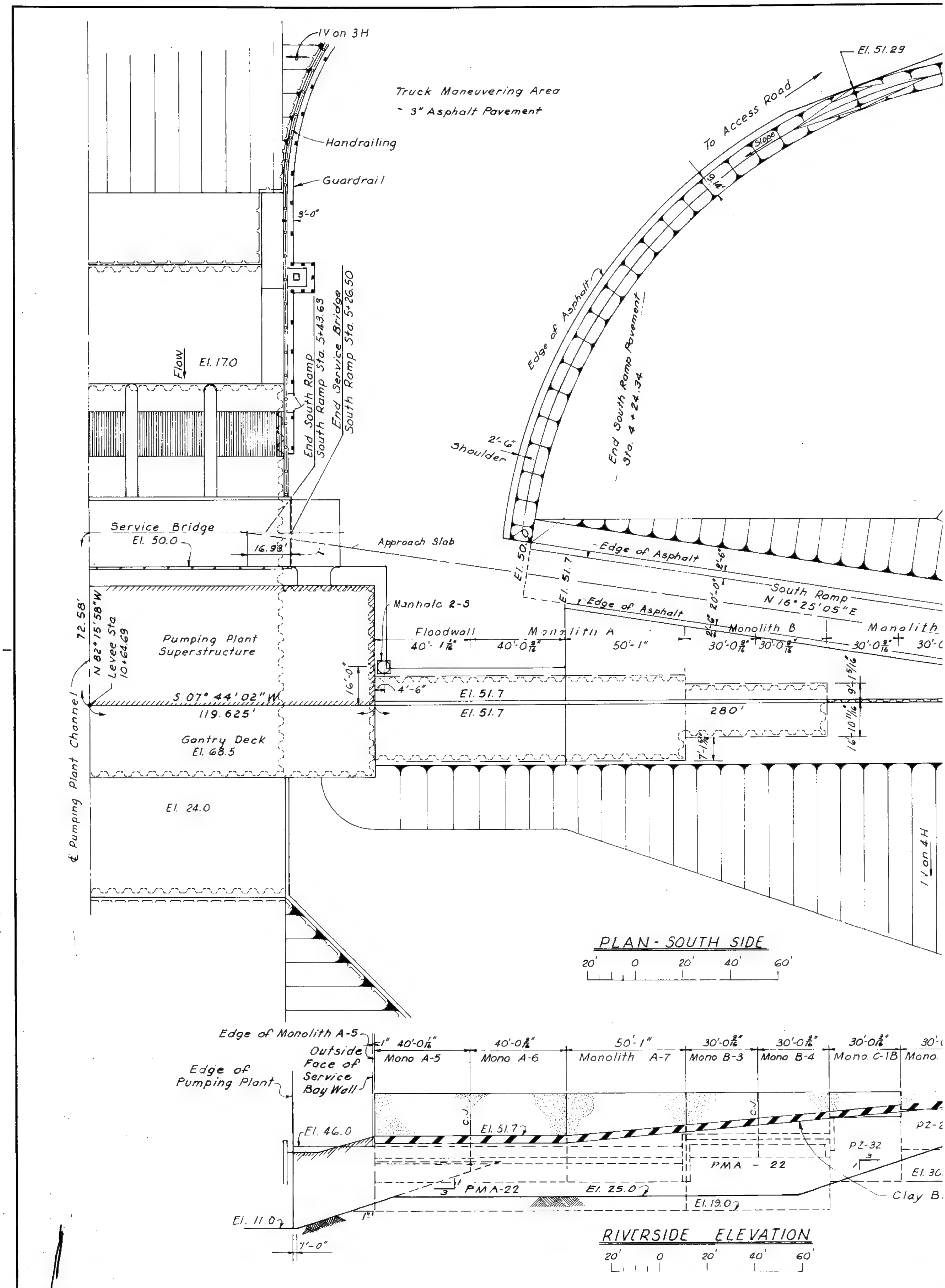
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

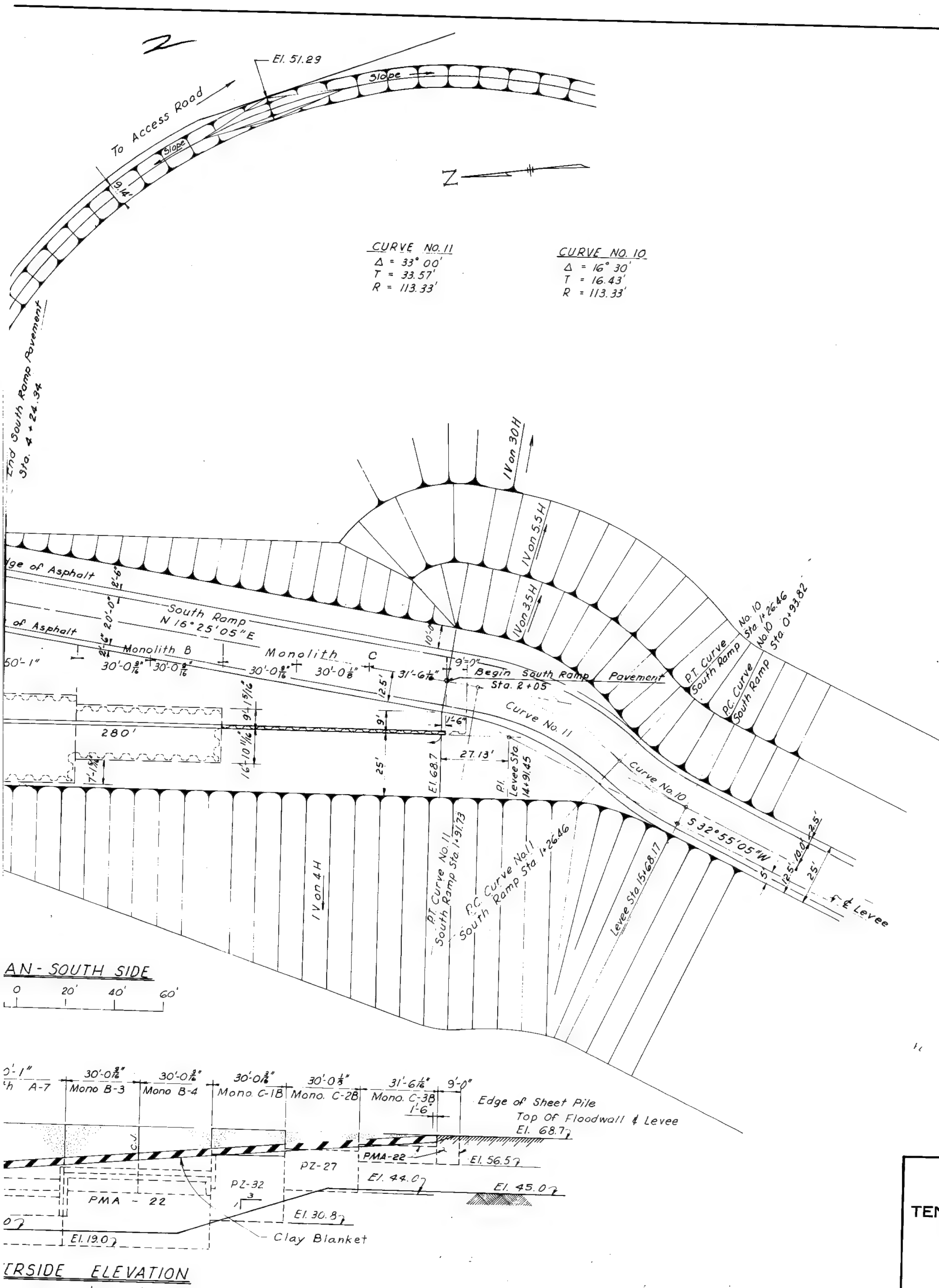
FOUNDATION REPORT

UPPER WEIR SITE PLAN AND SECTION

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



1V on 3H
Truck Maneuvering Area
~ 3" Asphalt Pavement
Handrailing
Guardrail
3'-0"
El. 51.29
To Access Road
Slope
9.14'
Edge of Asphalt
End South Ramp Pavement
Sta. 4 + 24.34
Flow
El. 17.0
End South Ramp
South Ramp Sta. 5+43.63
End Service Bridge
South Ramp Sta. 5+26.50
2'-6"
Shoulder
Service Bridge
El. 50.0
16.93'
1'
Approach Slab
El. 50.0
El. 51.7
Edge of Asphalt
2'-6"
20'-0"
South Ramp
N 16° 25' 05" E
Manhole 2-5
72.58'
N 82° 15' 58" W
Levee Sta
10+64.69
Pumping Plant Superstructure
Floodwall
40'-1 1/16"
40'-0 9/16"
Monolith A
50'-1"
Monolith B
30'-0 9/16"
30'-0 9/16"
Monolith
30'-0 9/16"
16'-0"
4'-6"
El. 51.7
9 1/2"
15/16"
S 07° 44' 02" W
119.625'
El. 51.7
280'
16'-10 11/16"
7'-1 3/8"
℄ Pumping Plant Channel
Gantry Deck
El. 68.5
El. 24.0
1V on 4H
PLAN - SOUTH SIDE
20' 0 20' 40' 60'
Edge of Monolith A-5
Outside Face of Service Bay Wall
Edge of Pumping Plant
1"
40'-0 1/16"
40'-0 9/16"
50'-1"
30'-0 9/16"
30'-0 9/16"
30'-0 9/16"
Mono A-5
Mono A-6
Monolith A-7
Mono B-3
Mono B-4
Mono C-1B
Mono.
C.J.
C.J.
El. 51.7
El. 46.0
PZ-32
PMA - 22
PMA-22
3
El. 25.0
El. 19.0
El. 30.
Clay B.
El. 11.0
1"
7'-0"
RIVERSIDE ELEVATION
20' 0 20' 40' 60'
CITY BLUEPRINT 1375



...AN - SOUTH SIDE

0 20' 40' 60'

...RSIDE ELEVATION

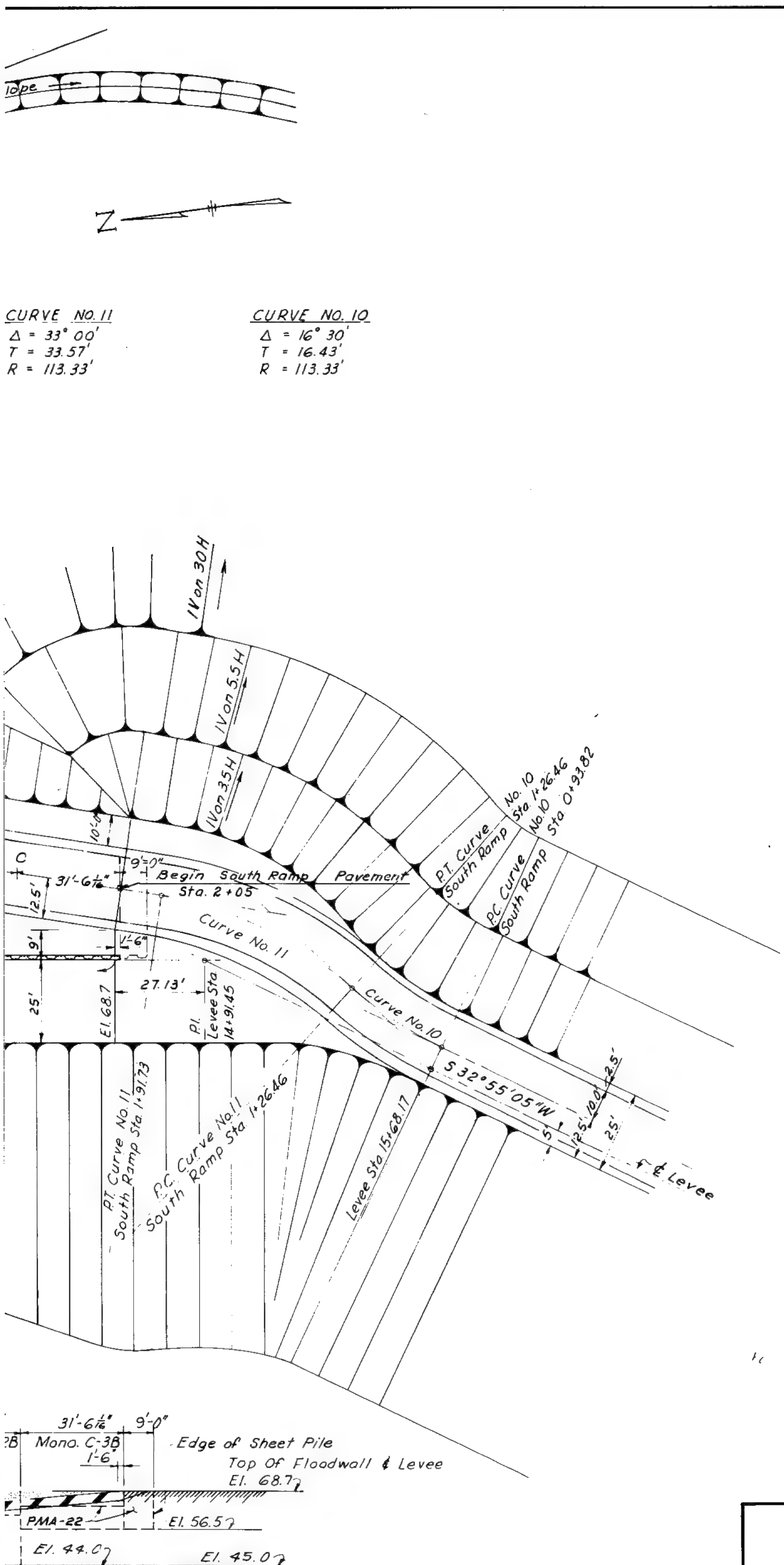
0 20' 40' 60'

TENSAS...
RED RIVER BAC...
LOUIS...

TENSAS-COCODRIE...
AND DRAINAG...
FOUNDATIO...

FLOODWALL PL...

SCALE A...
U. S. ARMY ENGINEER...
CORPS OF...
VICKSBURG...
DATE: AUGUST 1996



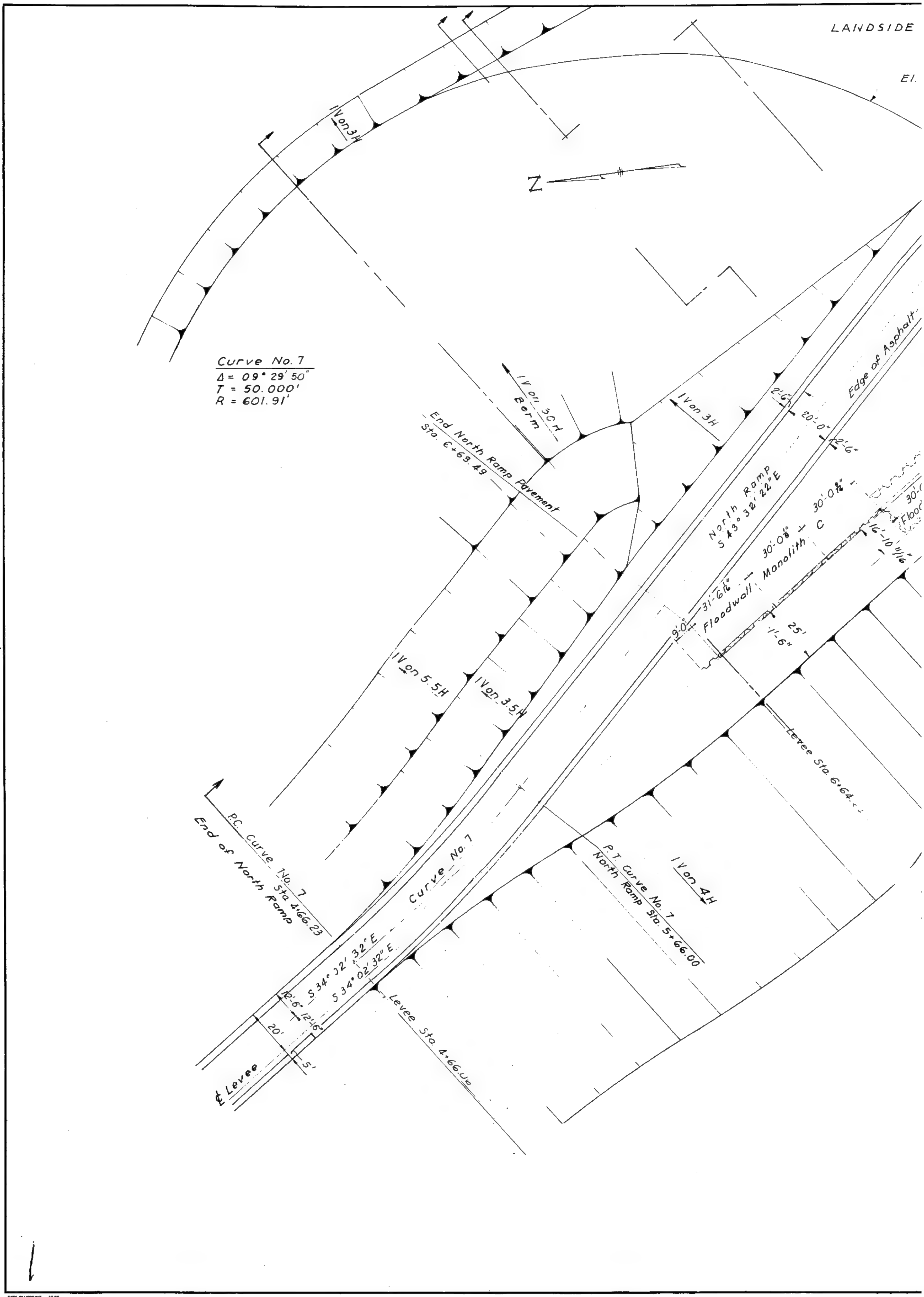
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

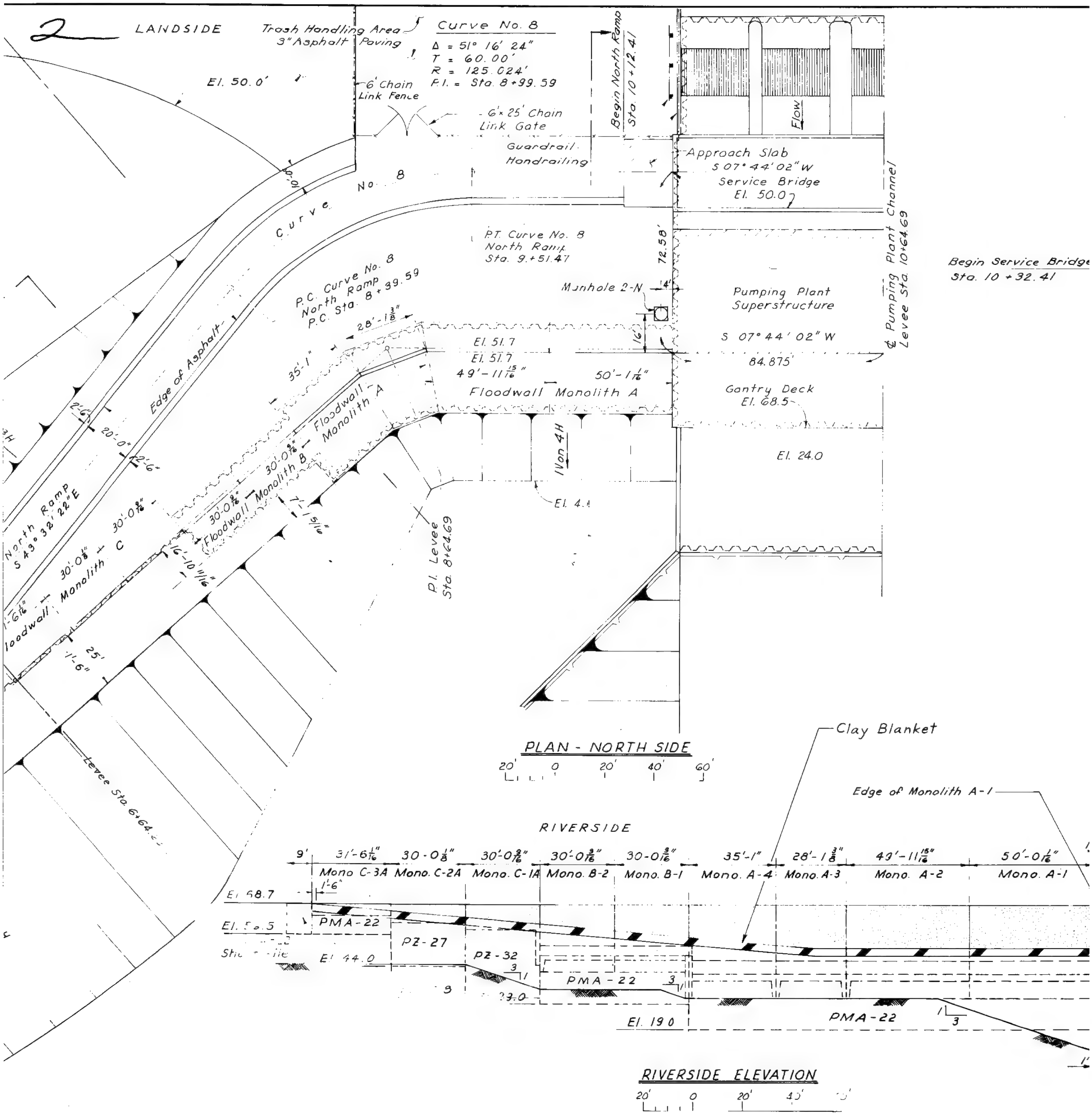
FOUNDATION REPORT

FLOODWALL PLAN-SOUTH SIDE

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



CITY BLUEPRINT



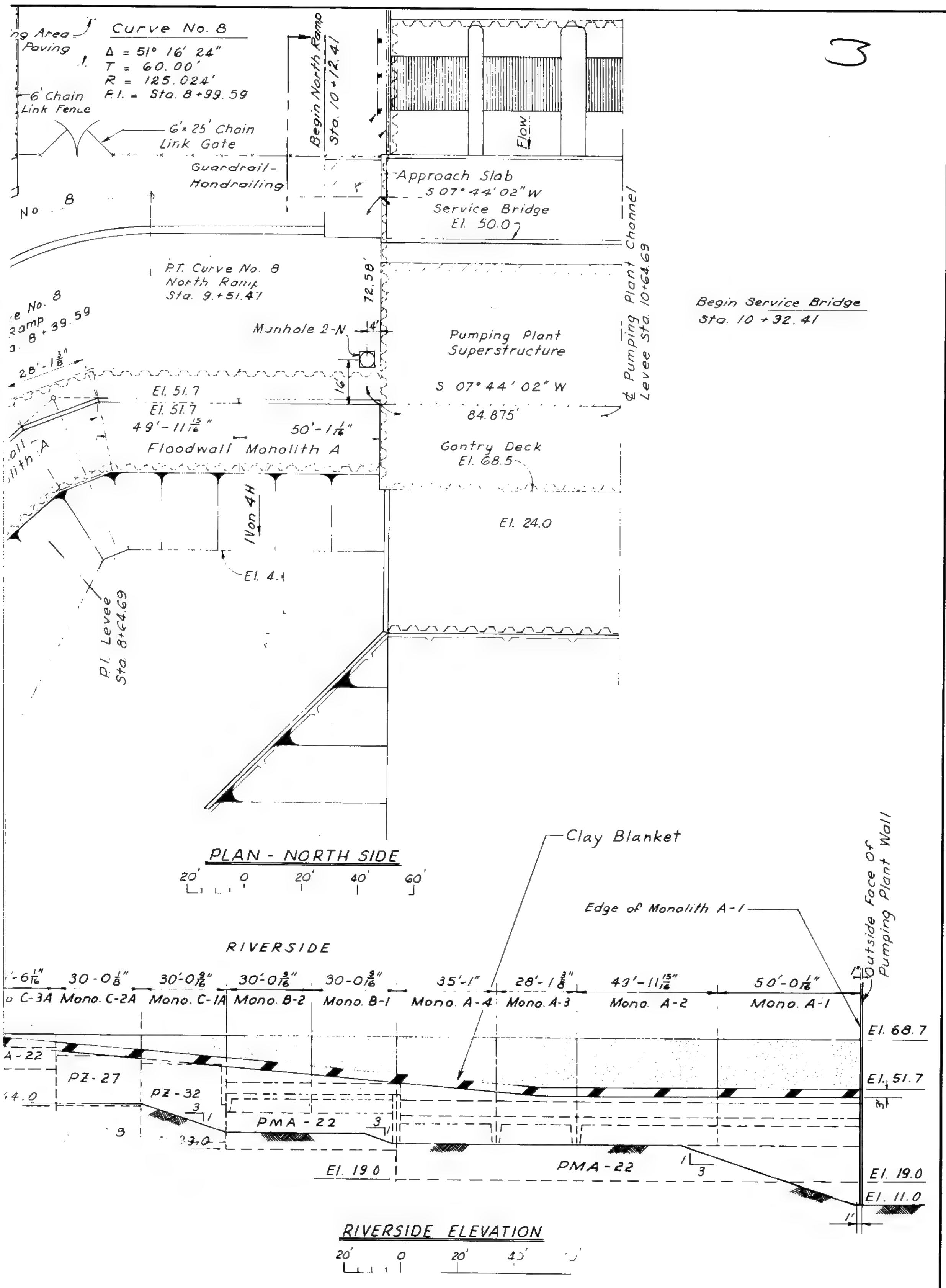
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING AND DRAINAGE STRUCTU

FOUNDATION REPORT

PUMPING PLANT NORTH FLOODWALL

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSE
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE N



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

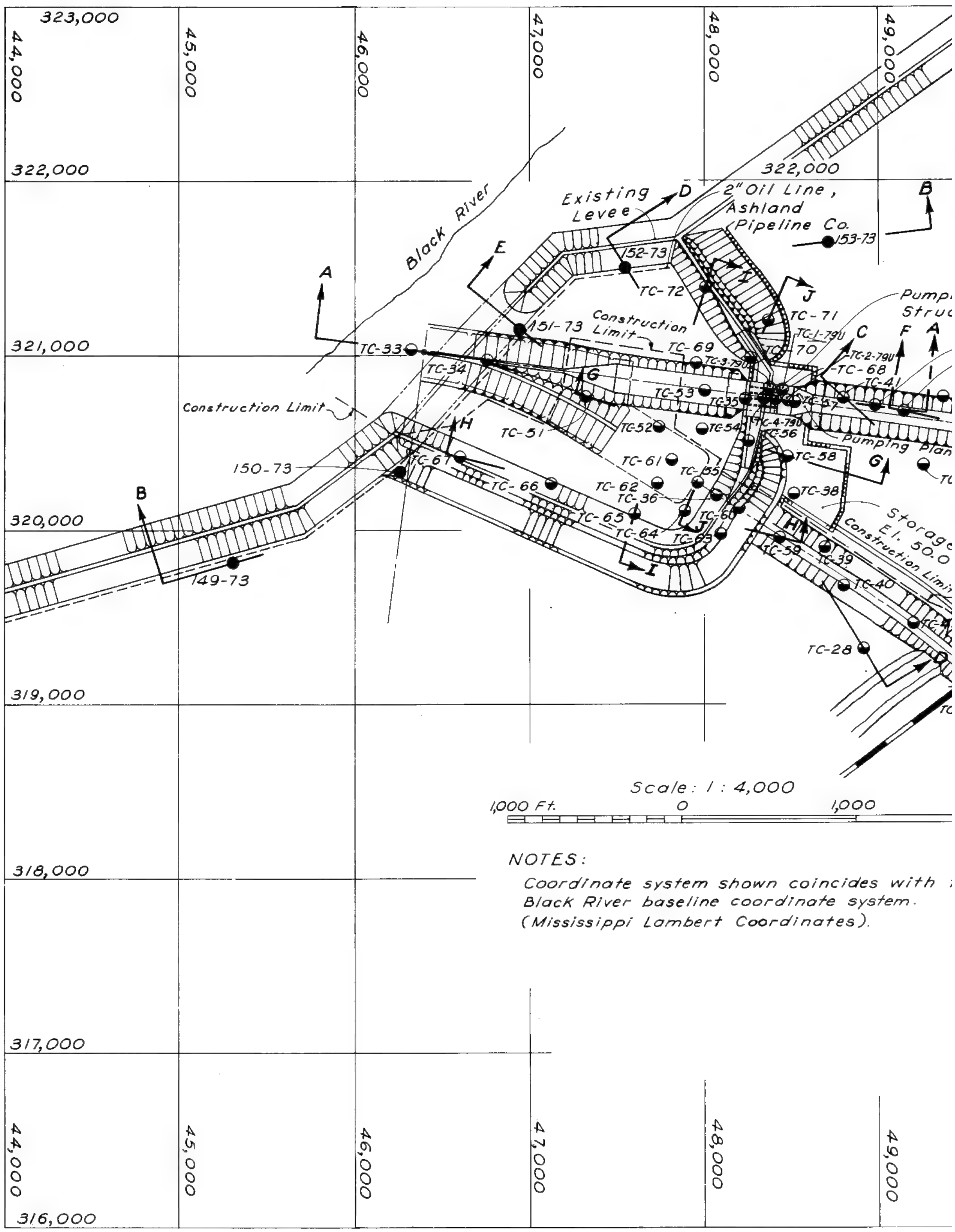
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

PUMPING PLANT
NORTH FLOODWALL

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

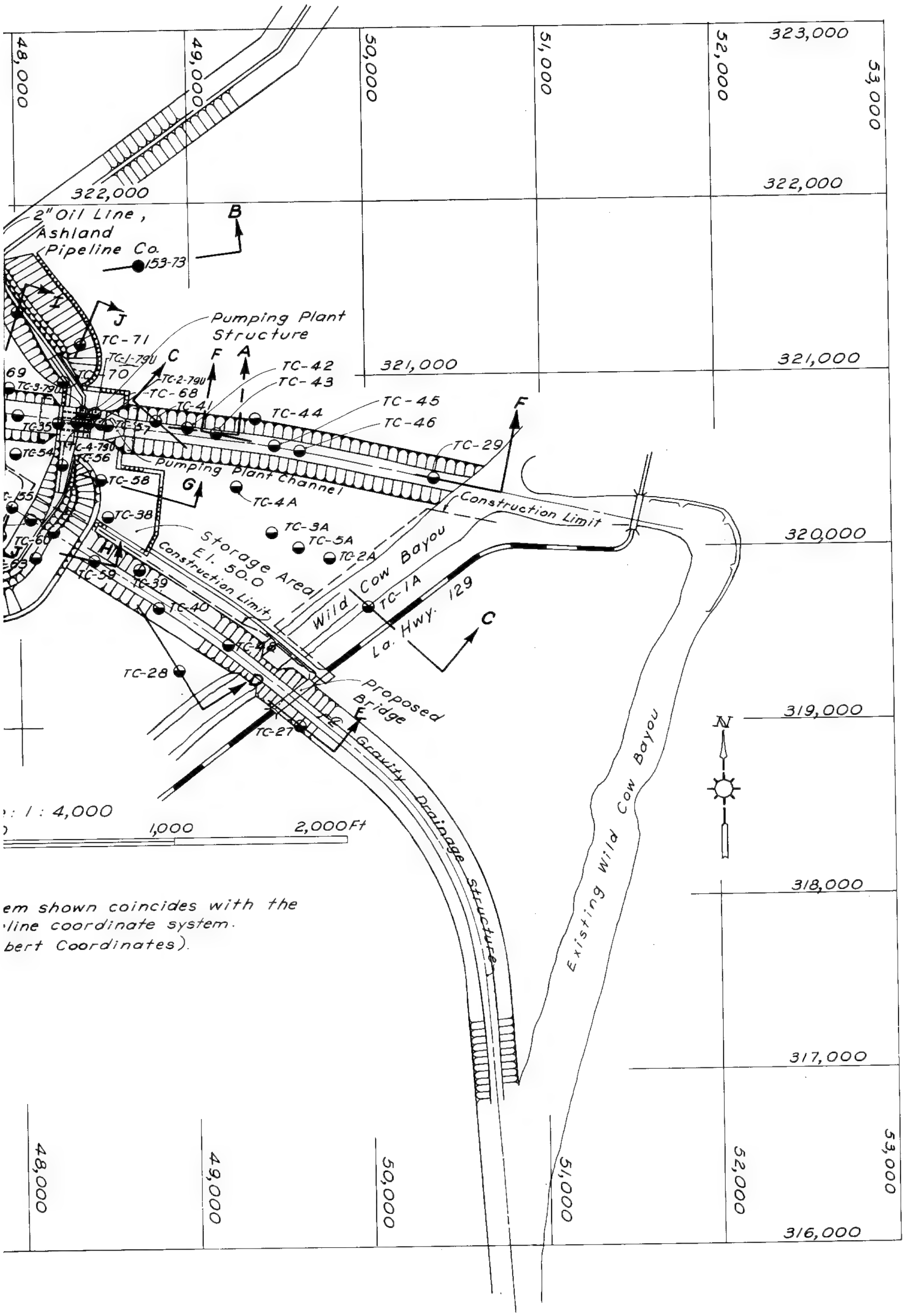
DATE: AUGUST 1996 FILE NO: T-14-37



NOTES:

Coordinate system shown coincides with
Black River baseline coordinate system.
(Mississippi Lambert Coordinates).

2



Legend.

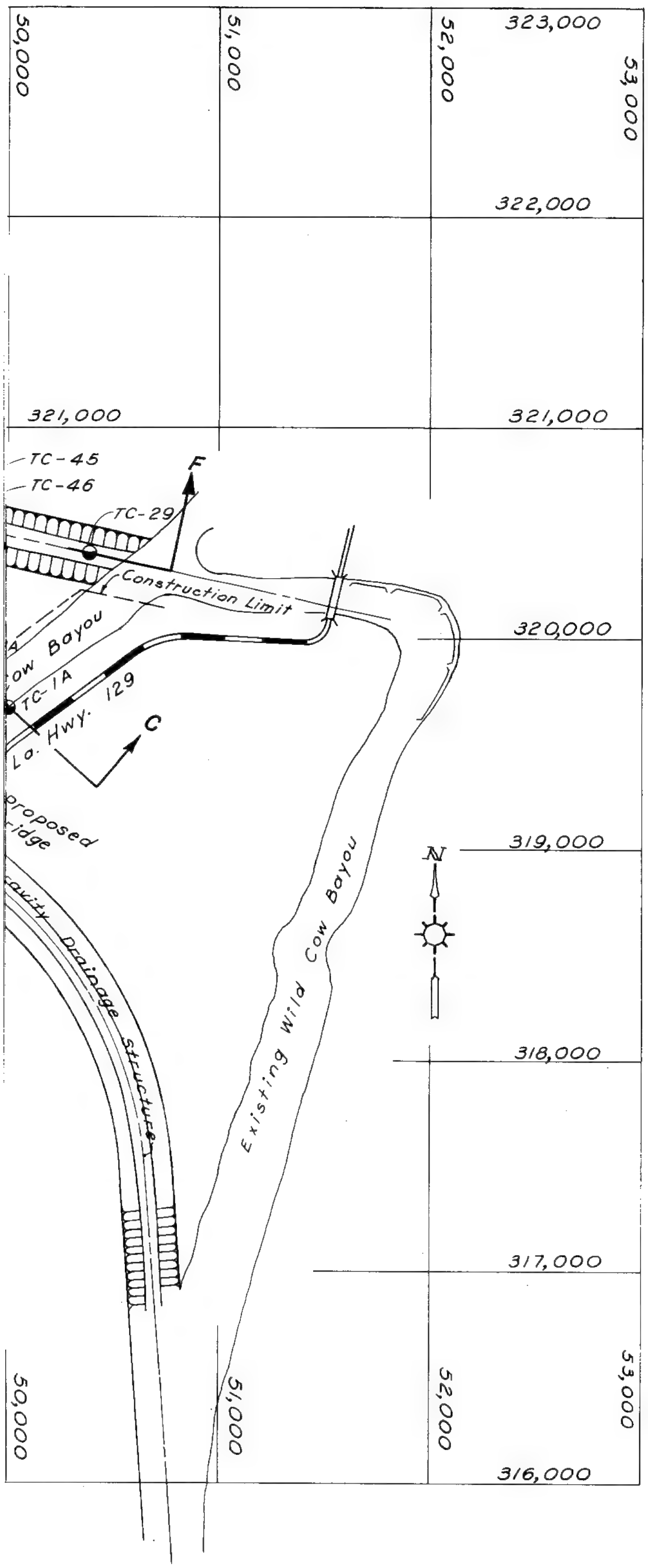
- Location of borings
- Location of borings from which undisturbed samples were taken.

TENSAS BAS
RED RIVER BACKWA
LOUISIANA

TENSAS-COCODRIE P
AND DRAINAGE S
FOUNDATION R

BORING LOCATIO

SCALE AS SH
U. S. ARMY ENGINEER DIST
CORPS OF ENG
VICKSBURG, MIS
DATE: AUGUST 1996



Legend.

- Location of borings
- Location of borings from which undisturbed samples were taken.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

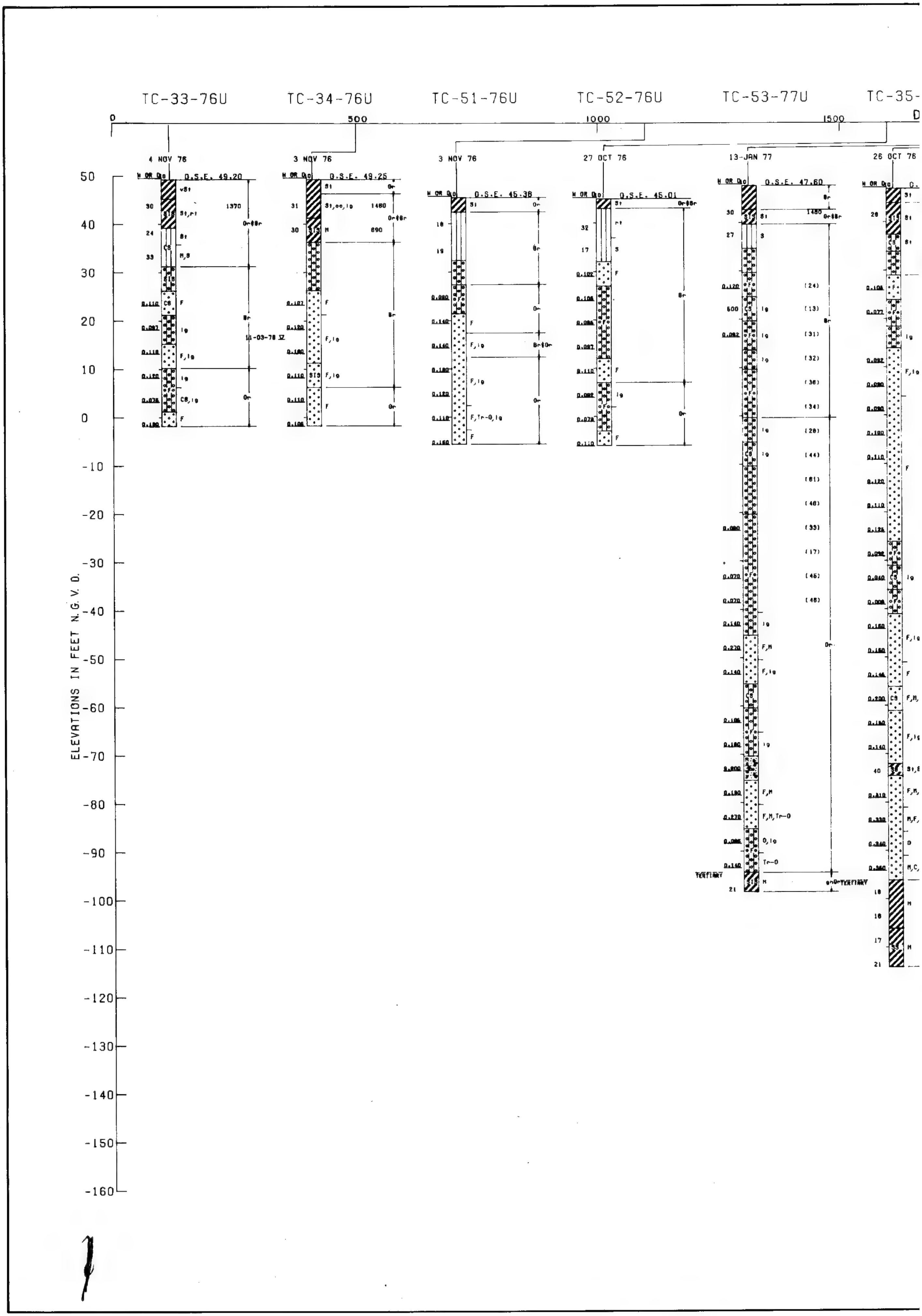
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

BORING LOCATION PLAN

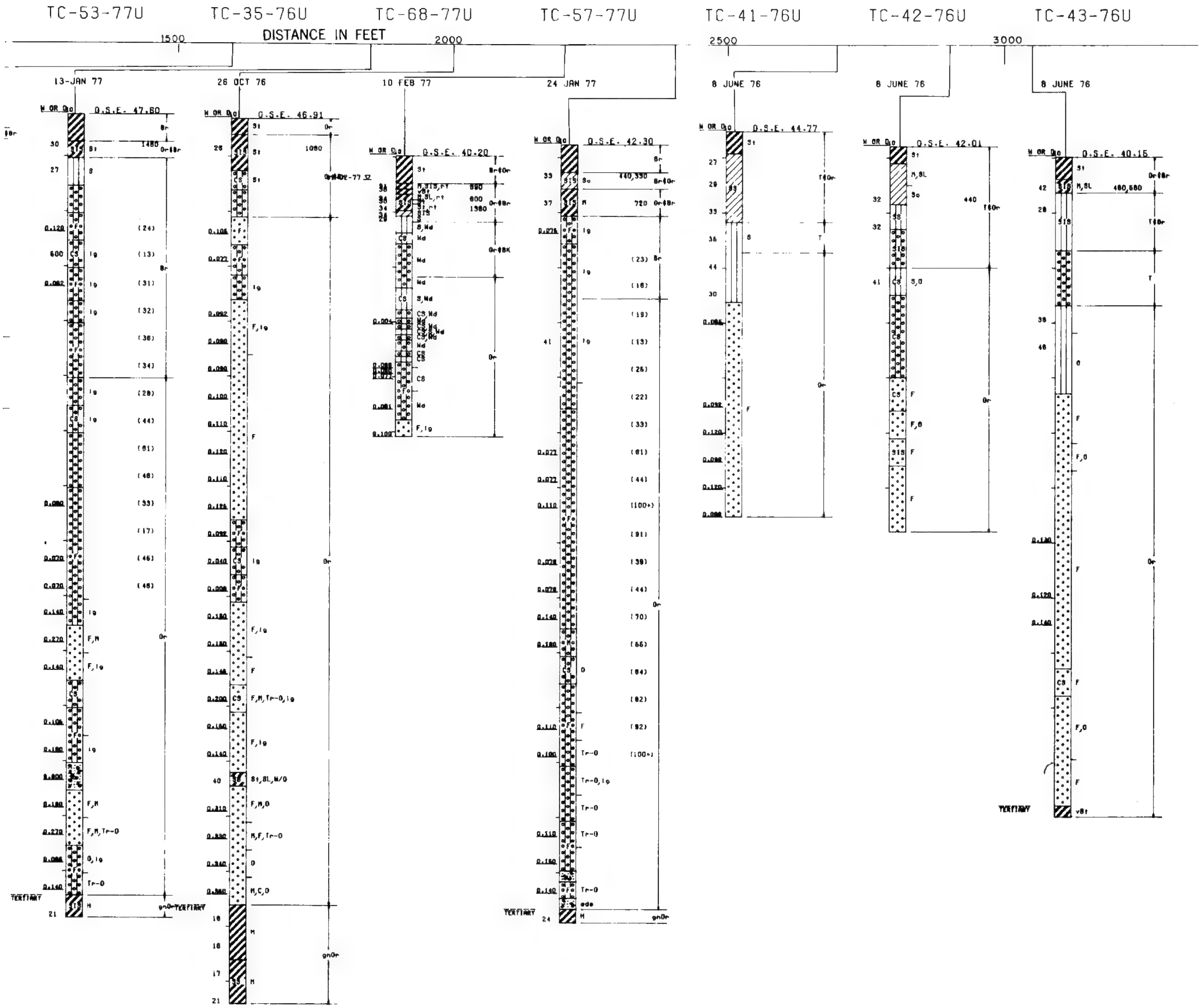
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



TC-33-76U
TC-34-76U
TC-51-76U
TC-52-76U
TC-53-77U
TC-35-
4 NOV 76
3 NOV 76
3 NOV 76
27 OCT 76
13-JAN 77
26 OCT 76
G.S.E. 49.20
G.S.E. 49.25
G.S.E. 45.38
G.S.E. 45.01
G.S.E. 47.60
ELEVATIONS IN FEET N.G.V.D.
TERTIARY

2



NOTE: SEE DWG NO. 8 FOR BORING PROFILE LOCATIONS.

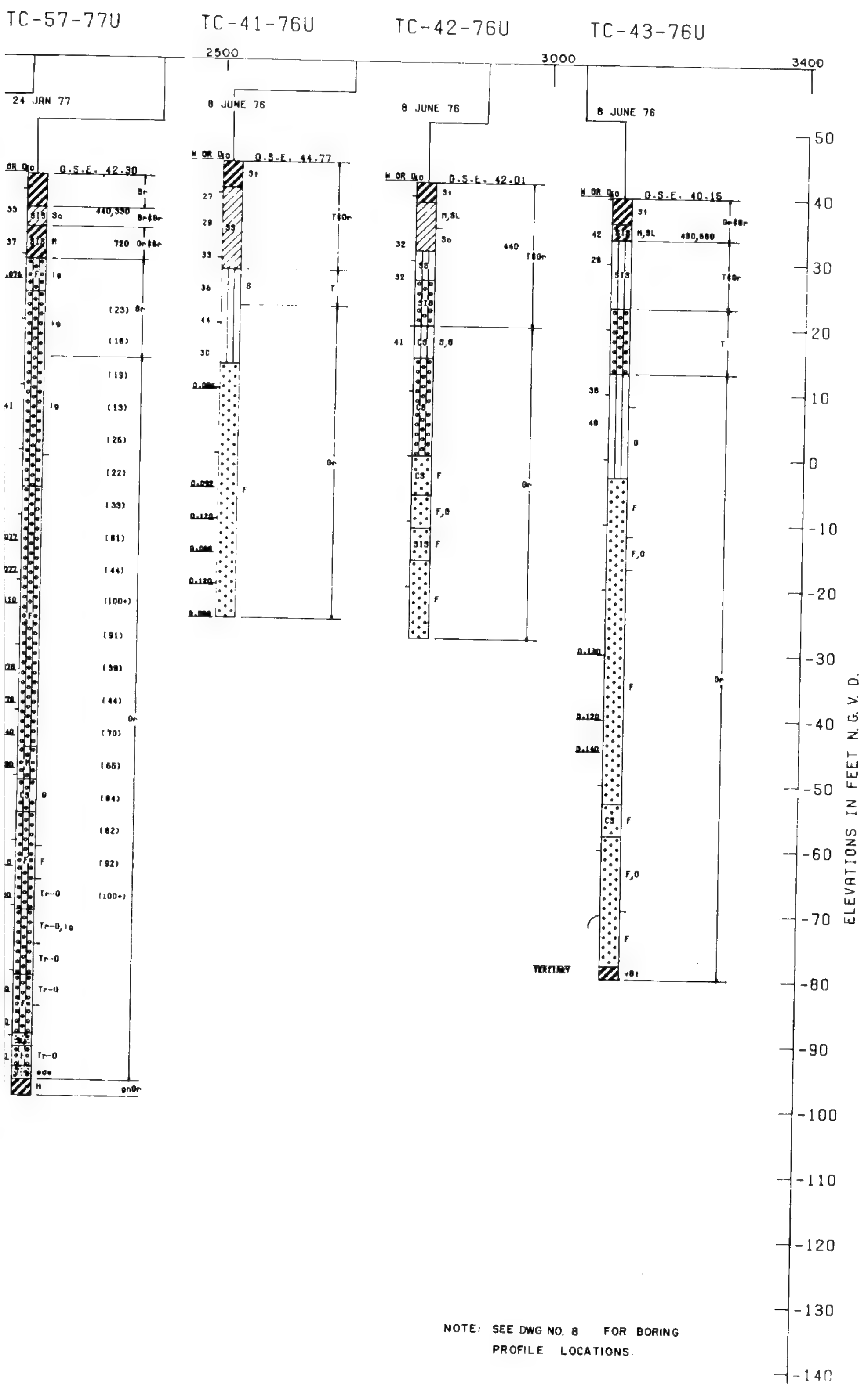
BORINGS MADE BY ROTARY DRILLING METHOD W/MUD JUN.OCT.AND NOV 1976. AND JAN AND FEB 1977 OPEN SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE.BORING BOOKS 6065.6106.6113. BORINGS MADE BY EUSTIS ENGINEERING COMPANY ARE: TC-41-76U.TC-42-76U.TC-43-76U.

TENSAS BASIN
RED RIVER BACKWATE
LOUISIANA

TENSAS-COCODRIE PU
AND DRAINAGE ST
FOUNDATION REF

BORING PROFILE

SCALE AS SHOW
U. S. ARMY ENGINEER DISTRI
CORPS OF ENGINE
VICKSBURG, MISSIS
DATE: AUGUST 1996



NOTE: SEE DWG NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD JUN.,OCT.,AND NOV 1976, AND JAN AND FEB 1977 DEN SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE.BORING BOOKS 6065,6106,6113. BORINGS MADE BY EUSTIS ENGINEERING COMPANY ARE: TC-41-76U,TC-42-76U,TC-43-76U.

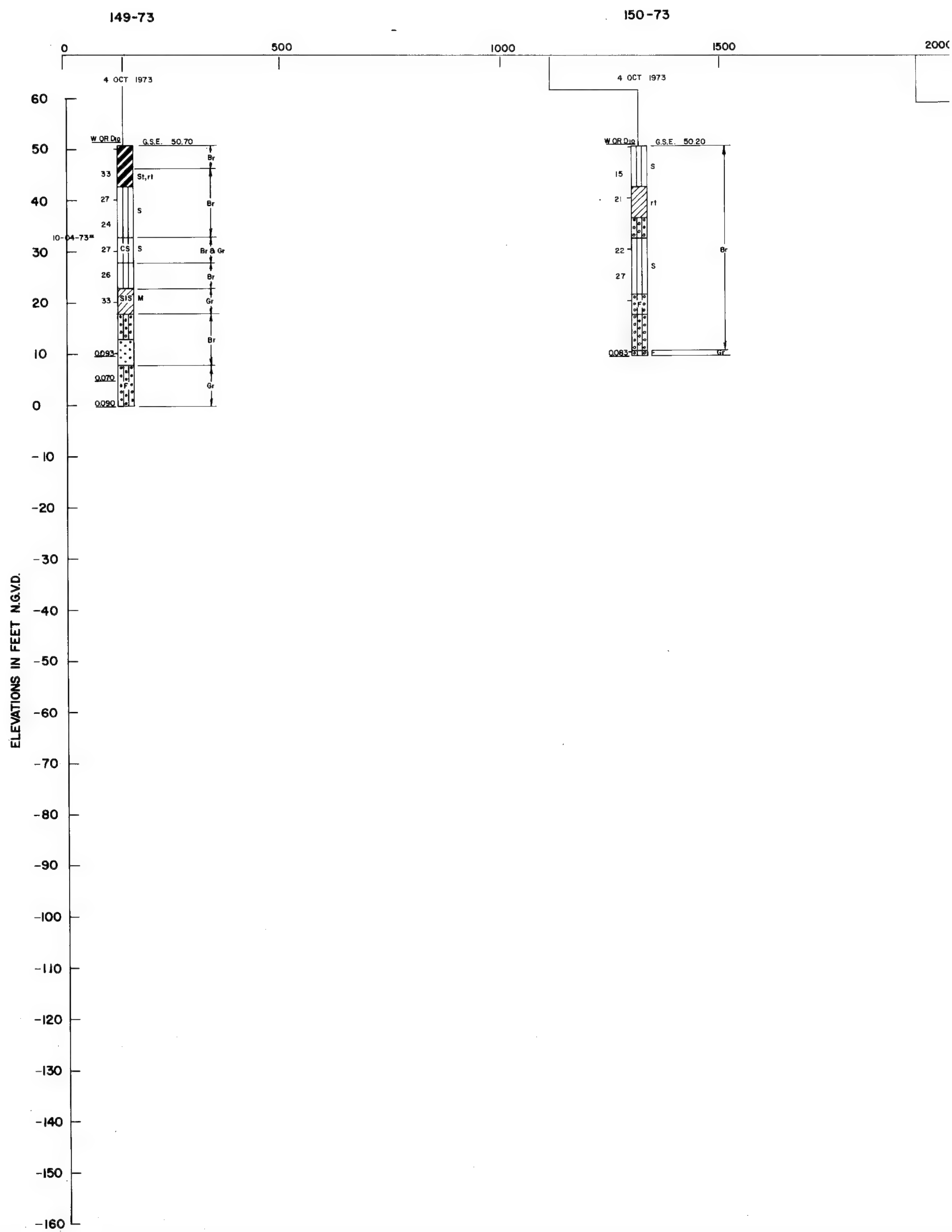
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

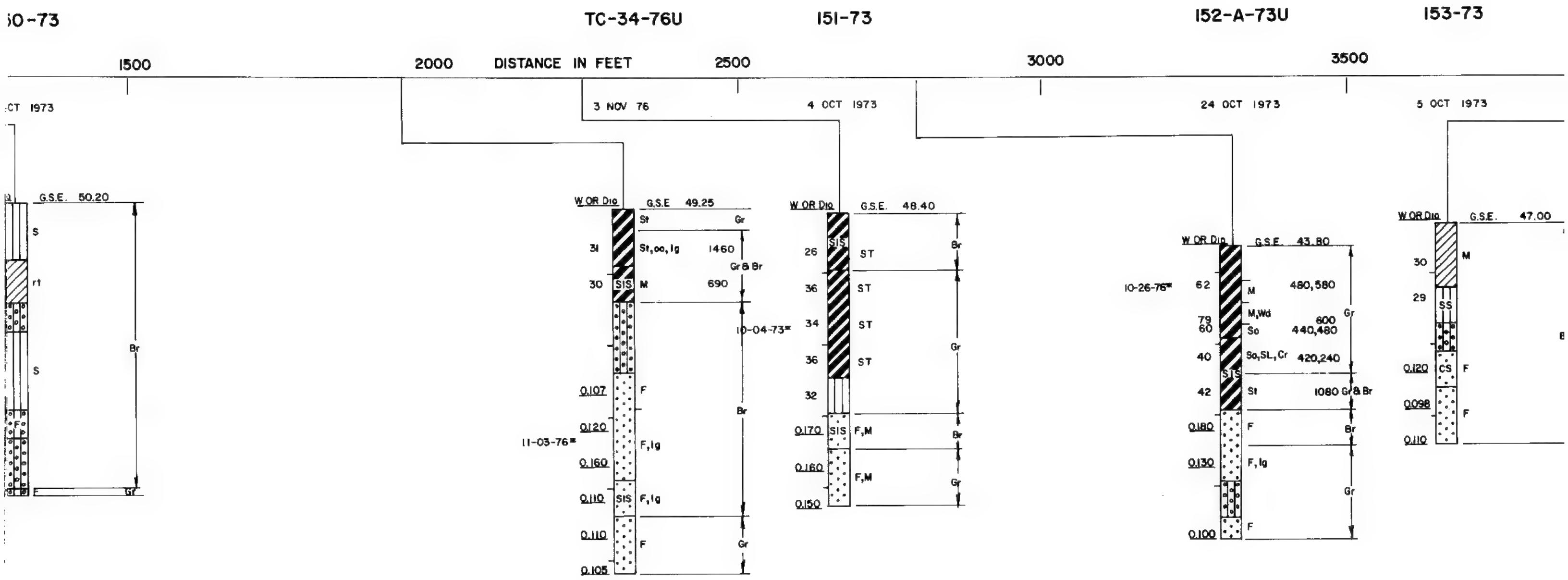
FOUNDATION REPORT

BORING PROFILE "A"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37


149-73
150-73
0
500
1000
1500
2000
4 OCT 1973
4 OCT 1973
ELEVATIONS IN FEET N.G.V.D.
W OR D10
G.S.E. 50.70
G.S.E. 50.20
10-04-73
St,rt
S
CS
SIS
M
Br
Br & Gr
Gr
rt
0.093
0.070
0.090
0.083
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160

2



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD OCT 1973 AND NOV 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH 5 IN. VACUUM TYPE SHELBY TUBE. BORING BOOK NO.S 5643, 5644, 5657, 6085.

TENSAS
RED RIVER BAC
LOUIS

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AND DRAINAG
FOUNDATI

BORING P

SCALE A
U. S. ARMY ENGINEEF
CORPS OF
VICKSBURG
DATE: AUGUST 1996

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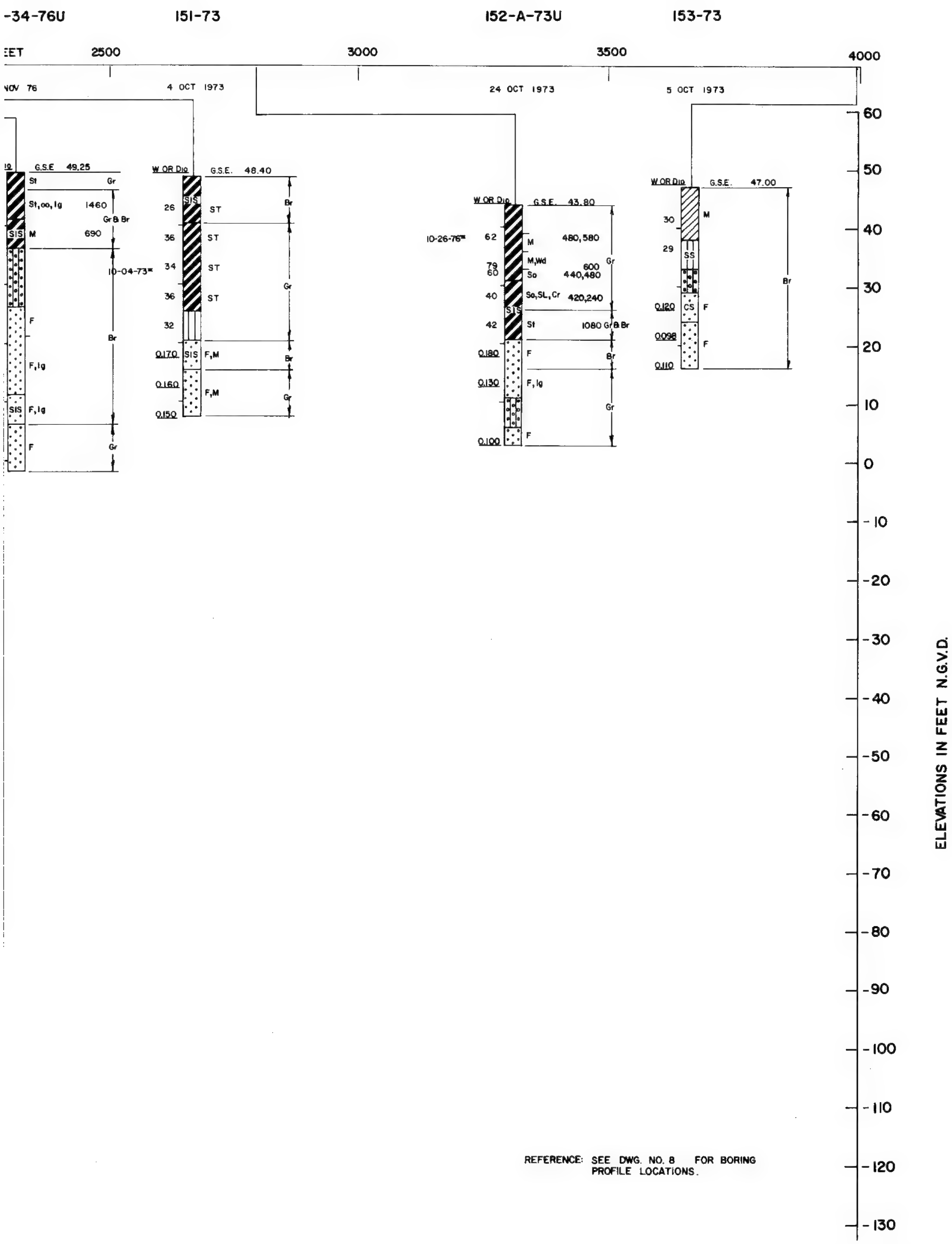


REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD OCT 1973 AND NOV 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH 5 IN. VACUUM TYPE SHELBY TUBE. BORING BOOK NO.S 5643, 5644, 5657, 6085.

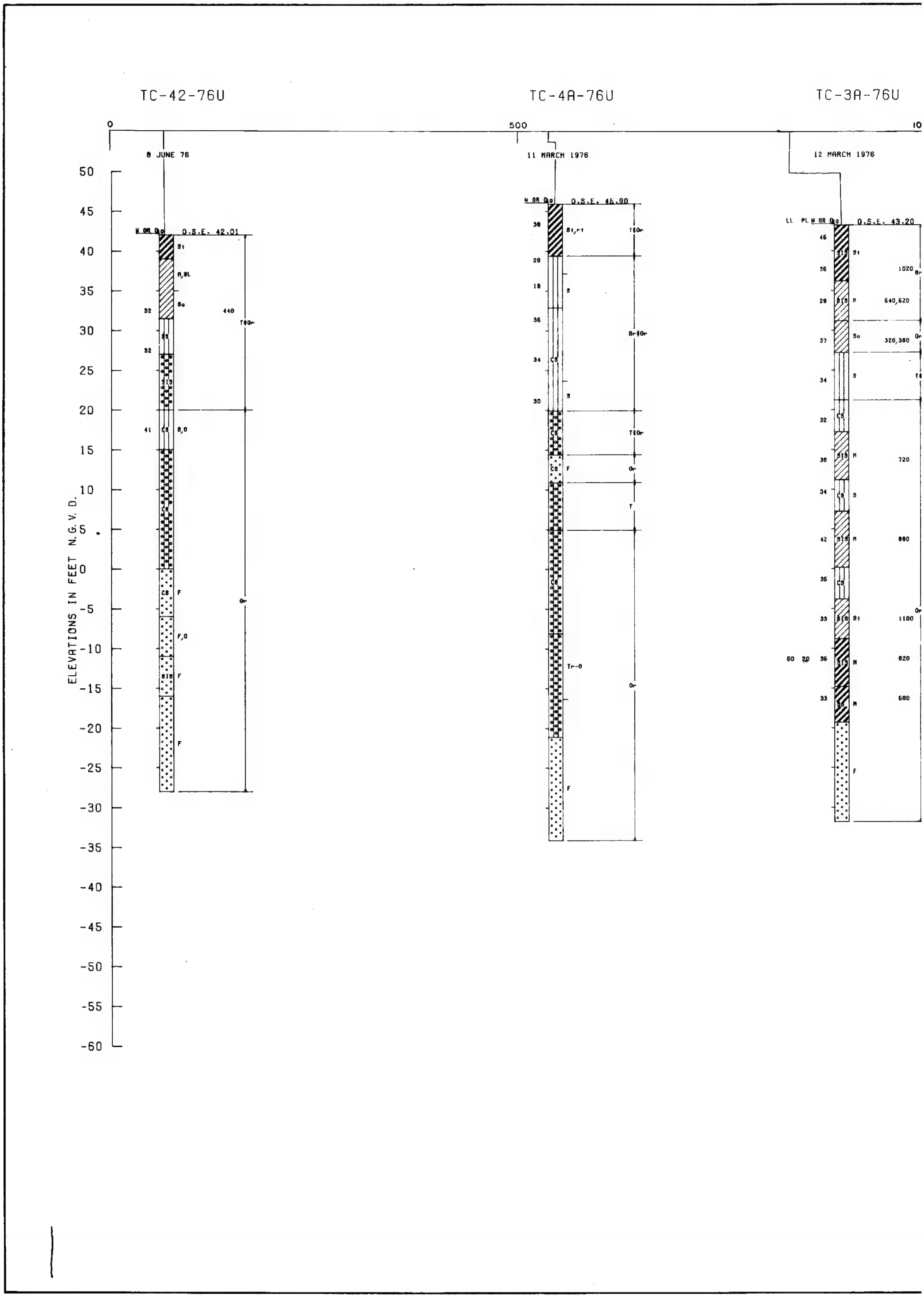
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

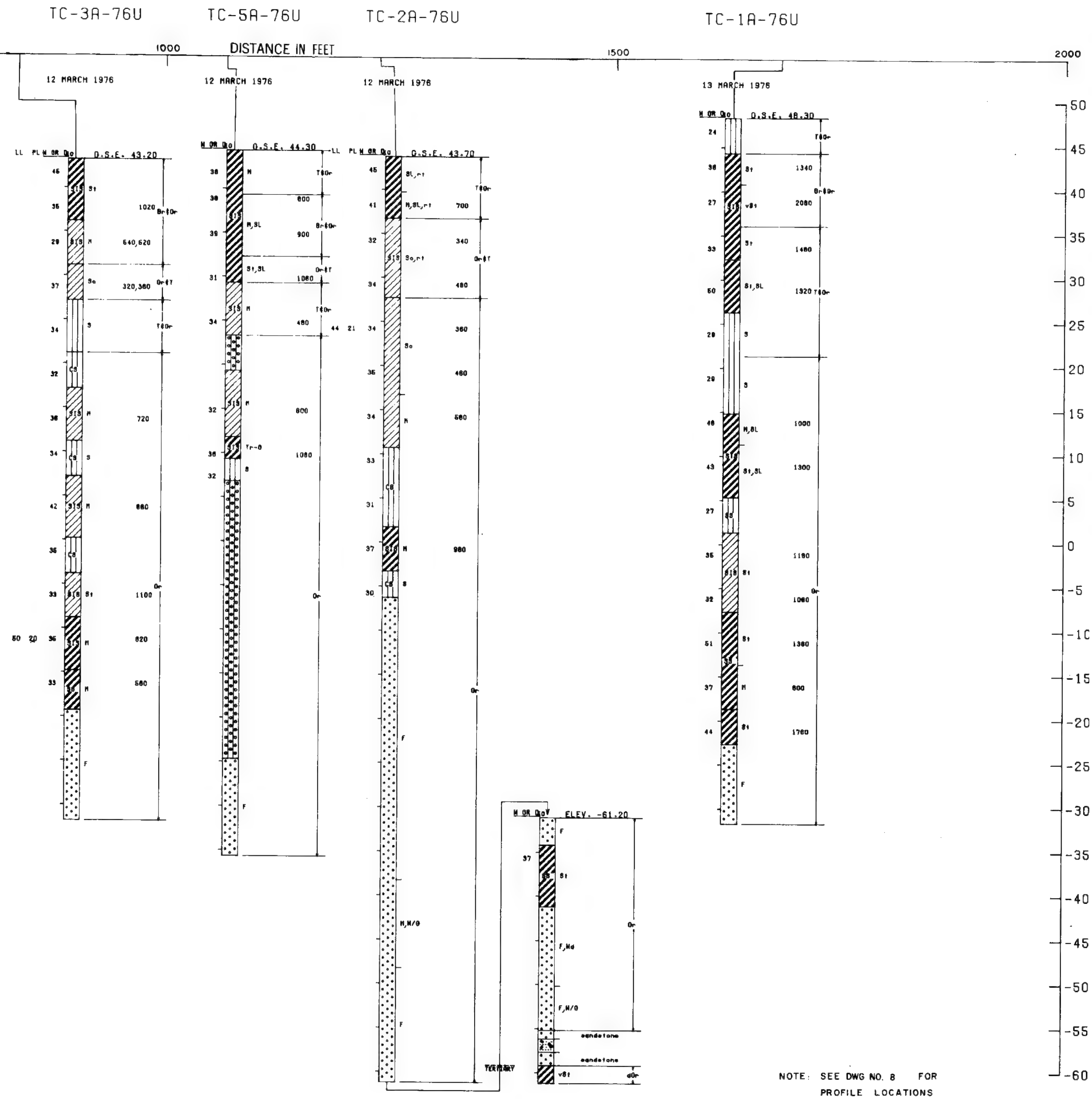
BORING PROFILE "B"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



TC-42-76U
TC-4A-76U
TC-3A-76U
0
500
8 JUNE 76
11 MARCH 1976
12 MARCH 1976
O.S.E. 42.01
O.S.E. 45.90
O.S.E. 43.20
ELEVATIONS IN FEET N.G.V.D.
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60

2



NOTE: SEE DWG NO. 8 FOR PROFILE LOCATIONS

BORINGS MADE BY EUSTIS ENGINEERING COMPANY DURING MARCH AND JUNE 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. OR 3 IN. DIAMETER DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN BY VACUUM TYPE SHELBY TUBE METHOD WITH 5 IN. DIAMETER TUBE.

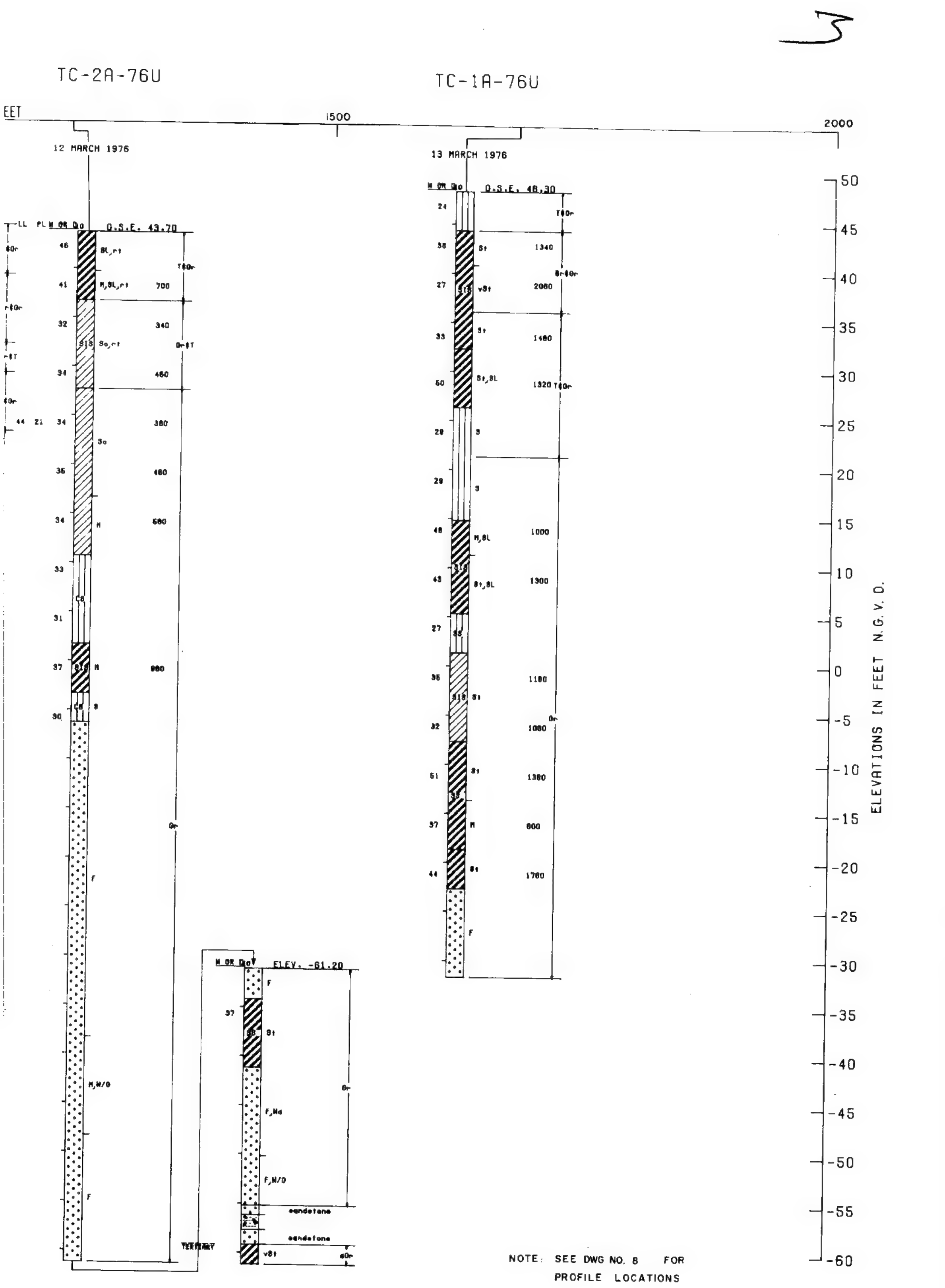
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING
AND DRAINAGE STRUCT

FOUNDATION REPORT

BORING PROFILE "C"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKS
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE



NOTE: SEE DWG NO. 8 FOR PROFILE LOCATIONS

BORINGS MADE BY EUSTIS ENGINEERING COMPANY DURING MARCH AND JUNE 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. OR 3 IN. DIAMETER DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN BY VACUUM TYPE SHELBY TUBE METHOD WITH 5 IN. DIAMETER TUBE.

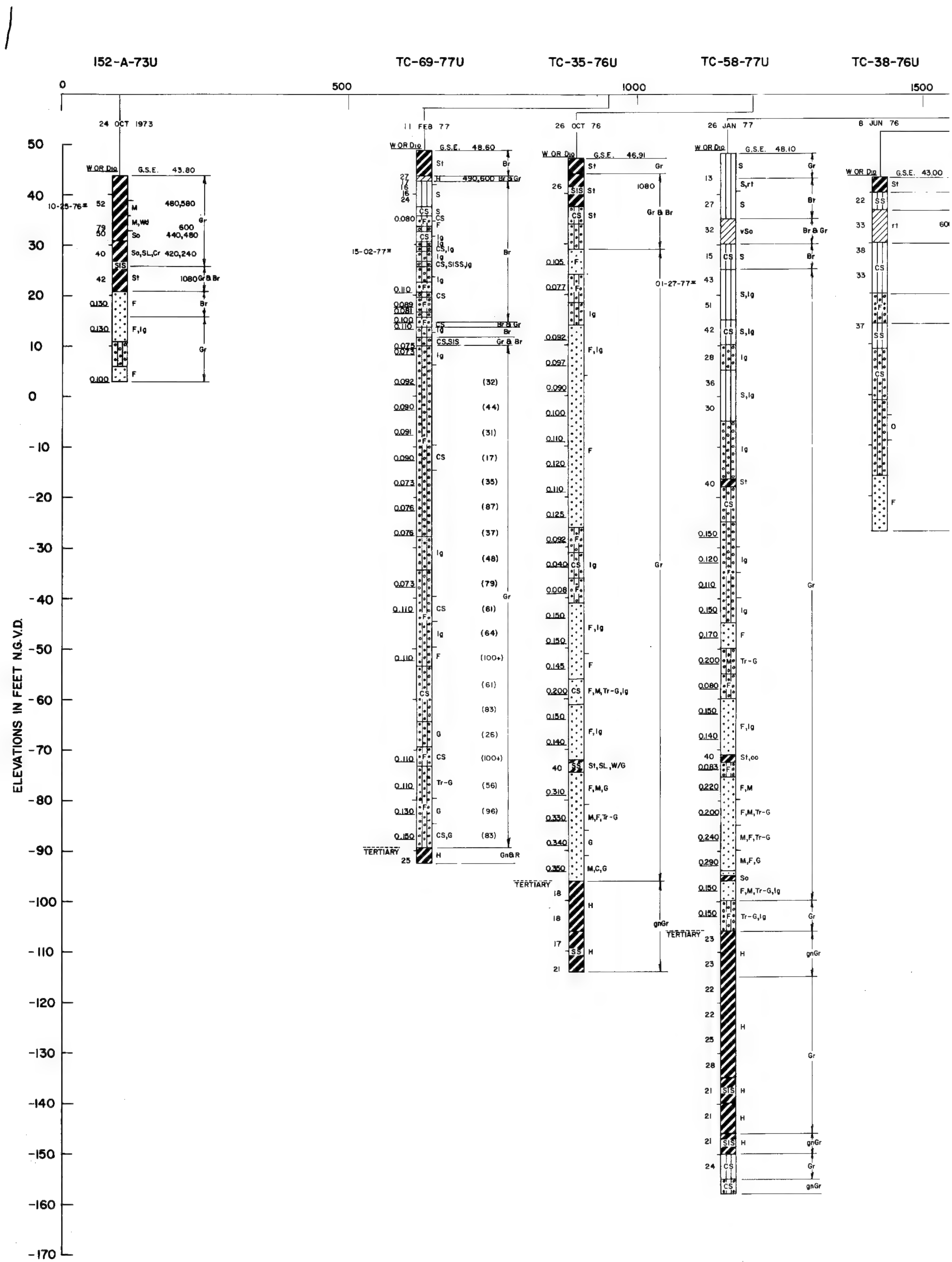
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

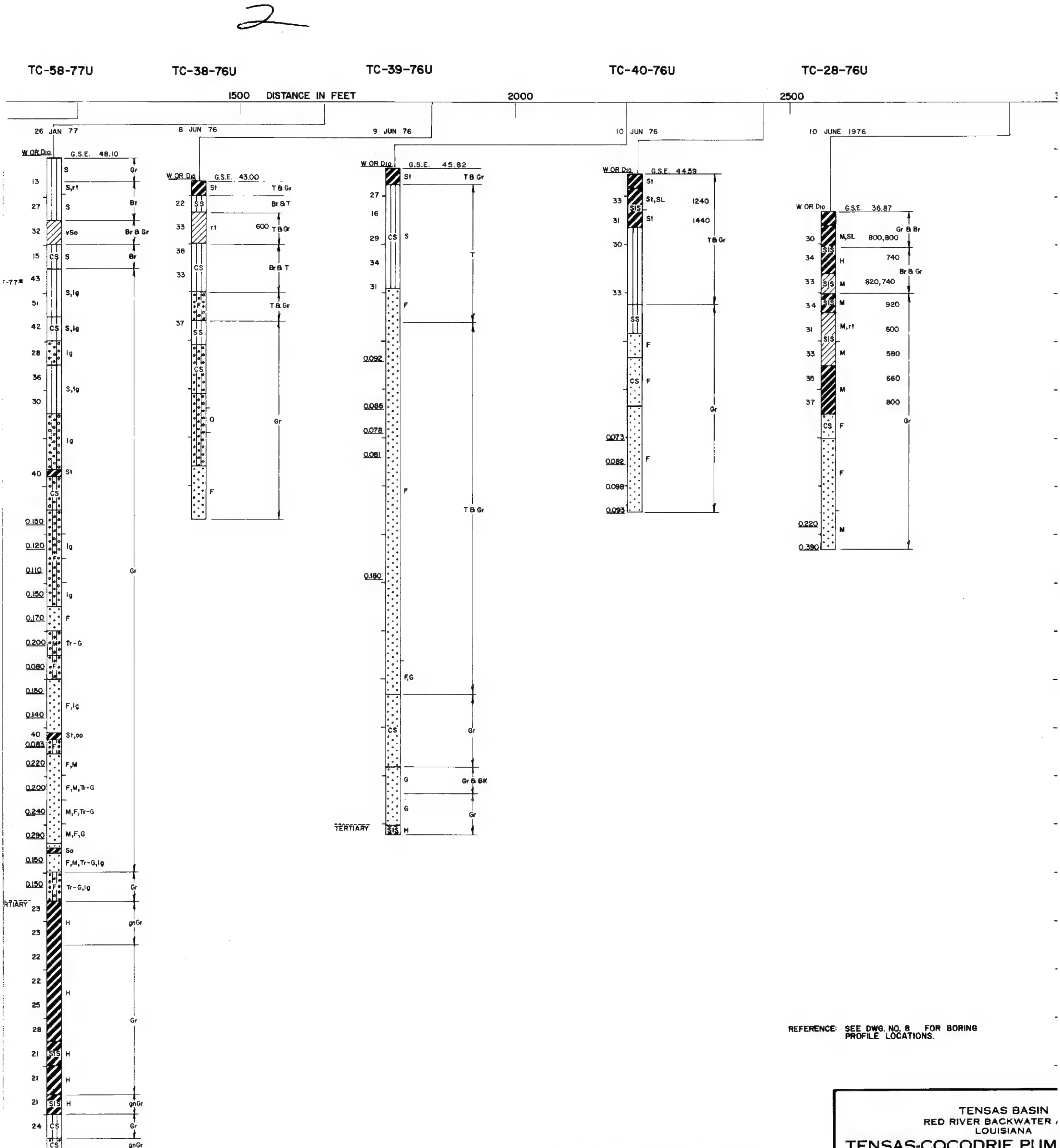
FOUNDATION REPORT

BORING PROFILE "C"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



152-A-73U
TC-69-77U
TC-35-76U
TC-58-77U
TC-38-76U
0
500
1000
1500
24 OCT 1973
11 FEB 77
26 OCT 76
26 JAN 77
8 JUN 76
G.S.E. 43.80
G.S.E. 48.60
G.S.E. 46.91
G.S.E. 48.10
G.S.E. 43.00
W OR D10
ELEVATIONS IN FEET N.G.V.D.
TERTIARY
10-25-76*
15-02-77*
01-27-77*



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING OCT 1973, JUNE, OCT, 1976, AND JAN, FEB 1977. GEN SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BKS. 5657, 6085, 6105, 6113.

BORINGS MADE BY EUSTIS ENGINEERING COMPANY ARE: TC-38-76U, TC-39-76U, TC-40-76U, TC-28-76U.

TENSAS BASIN
RED RIVER BACKWATER
LOUISIANA

TENSAS-COCODRIE PUM
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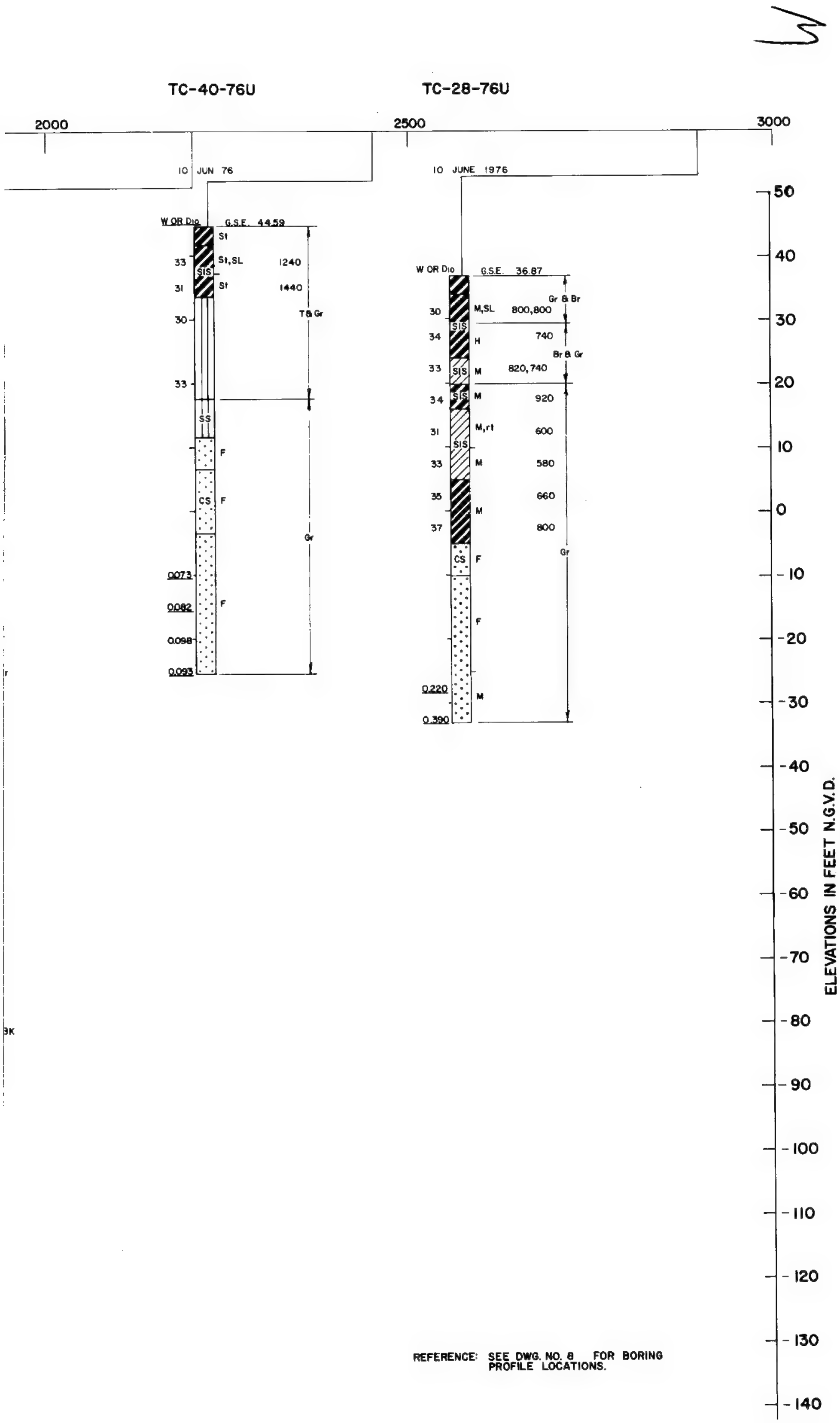
FOUNDATION REPO

BORING PROFILE "

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEE
VICKSBURG, MISSISSI
DATE: AUGUST 1996



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING OCT 1973, JUNE, OCT, 1976, AND JAN, FEB 1977. GEN SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BKS. 5657, 6085, 6105, 6113.

BORINGS MADE BY EUSTIS ENGINEERING COMPANY ARE: TC-38-76U, TC-39-76U, TC-40-76U, TC-28-76U.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

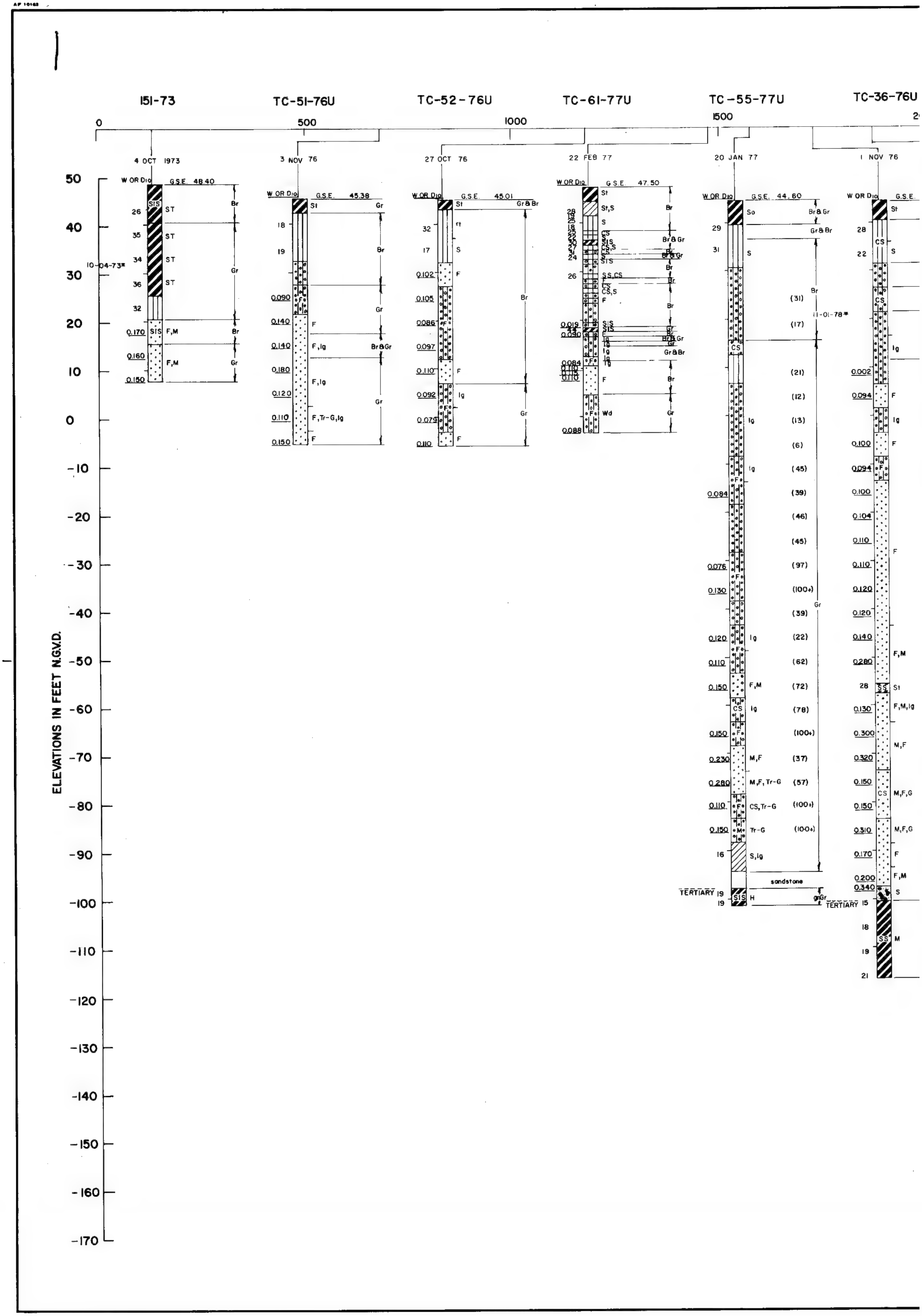
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

BORING PROFILE "D"

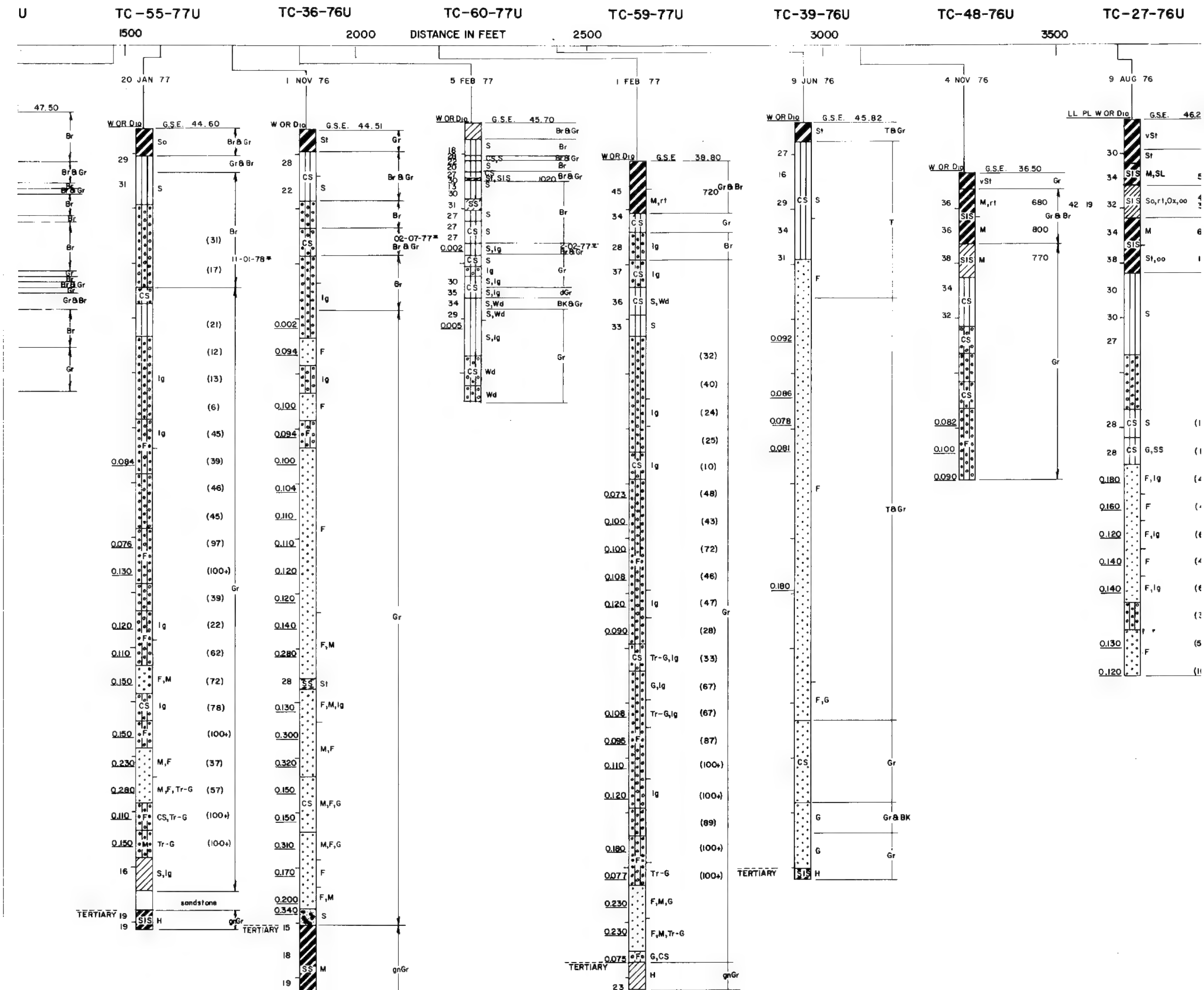
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

AP 10163



CITY BLUEPRINT 12-75

2



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING OCT 1973, JUNE, OCT, NOV 1976, AND JAN, FEB 1977. GEN SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOKS 5643, 6085, 6087, 6062, 6113, 6117.

BORING TC-39-76U WAS MADE BY EUSTIS ENGINEERING COMPANY.

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AND DRAINA
FOUNDA
BORING
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CORPS
VICKSBU
DATE: AUGUST 19

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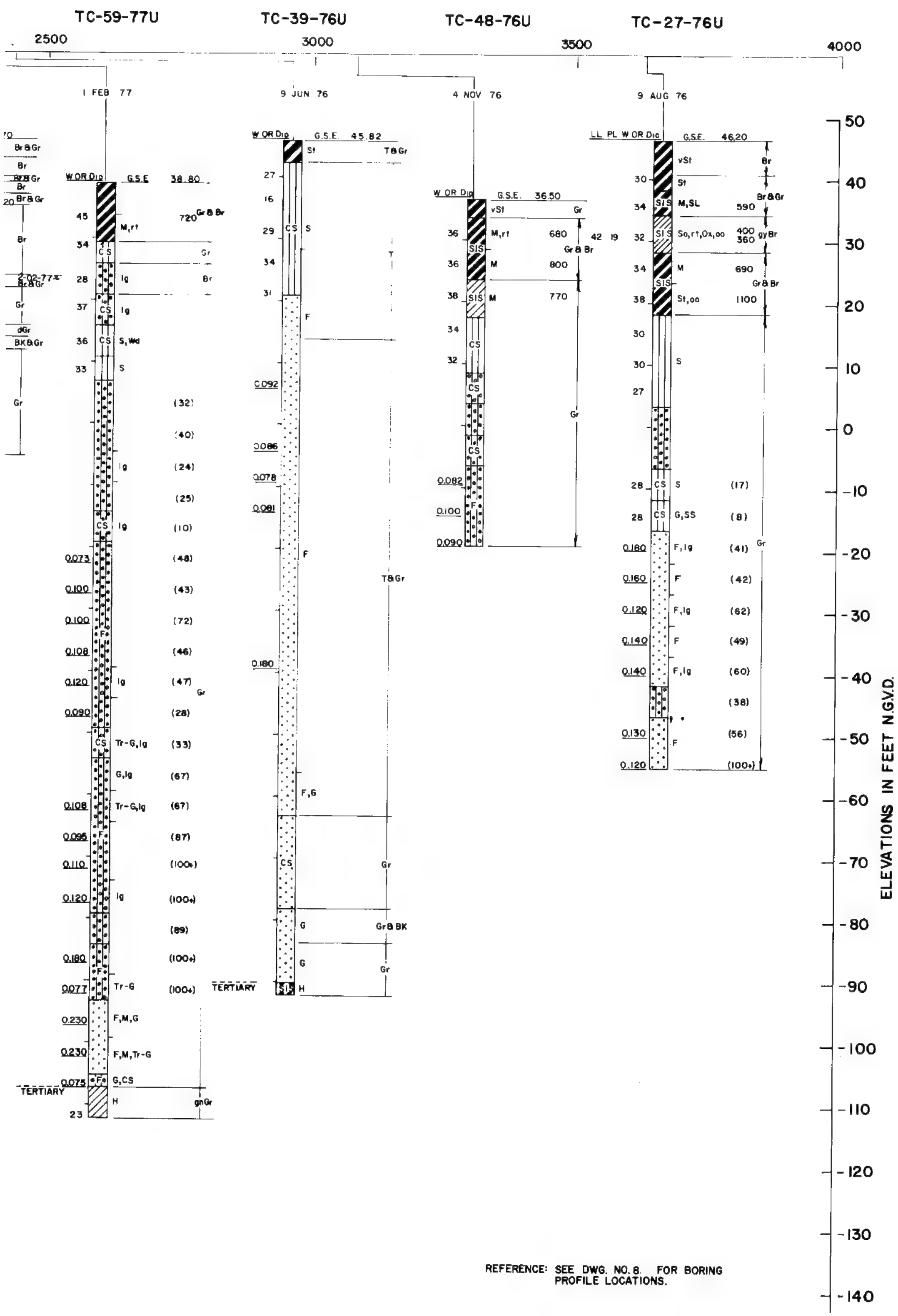


REFERENCE: SEE DWG. NO. 8. FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING OCT 1973, JUNE, OCT, NOV 1976, AND JAN, FEB 1977. GEN SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOKS 5643, 6085, 6087, 6062, 6113, 6117.

BORING TC-39-76U WAS MADE BY EUSTIS ENGINEERING COMPANY.

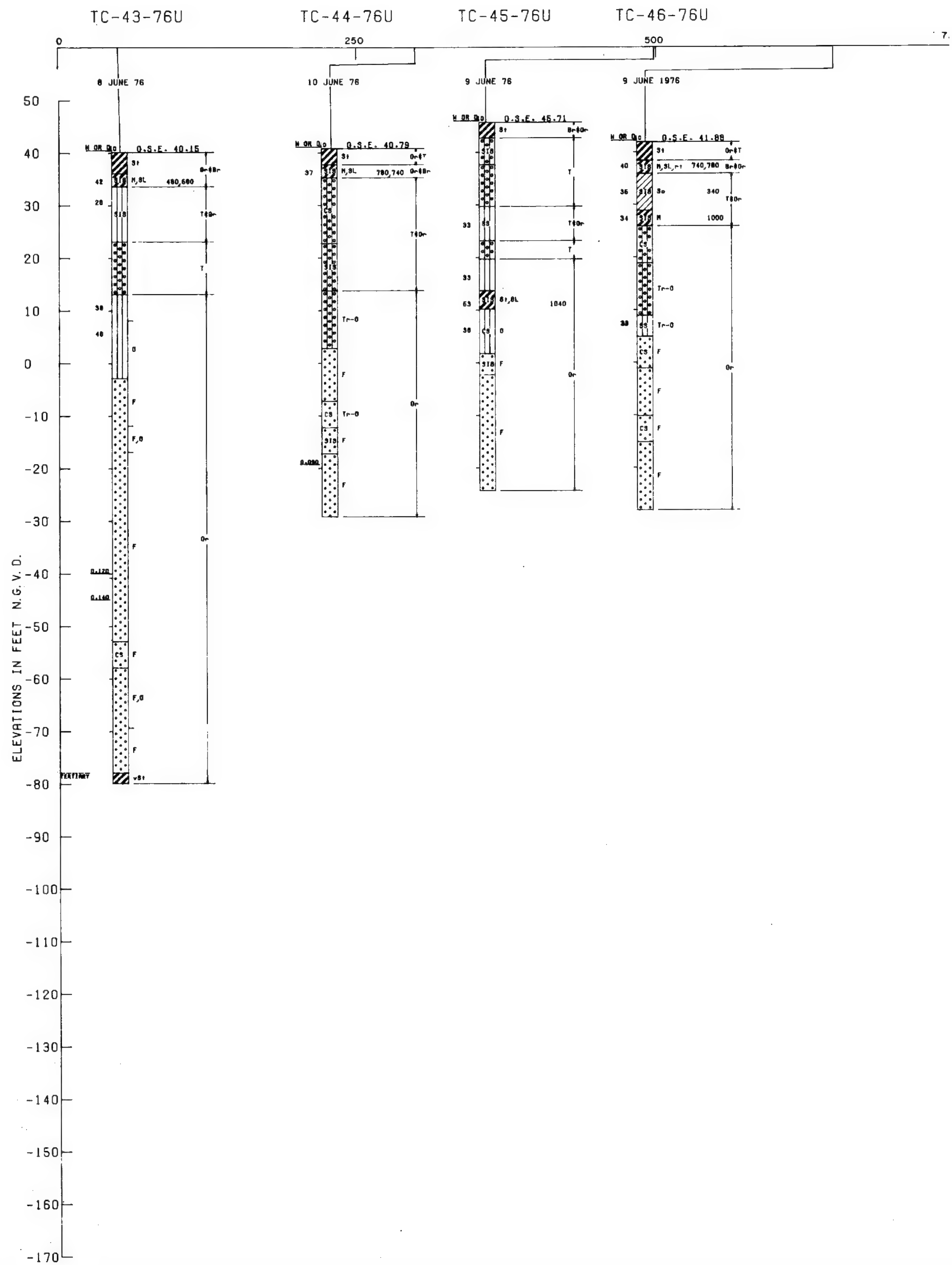
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

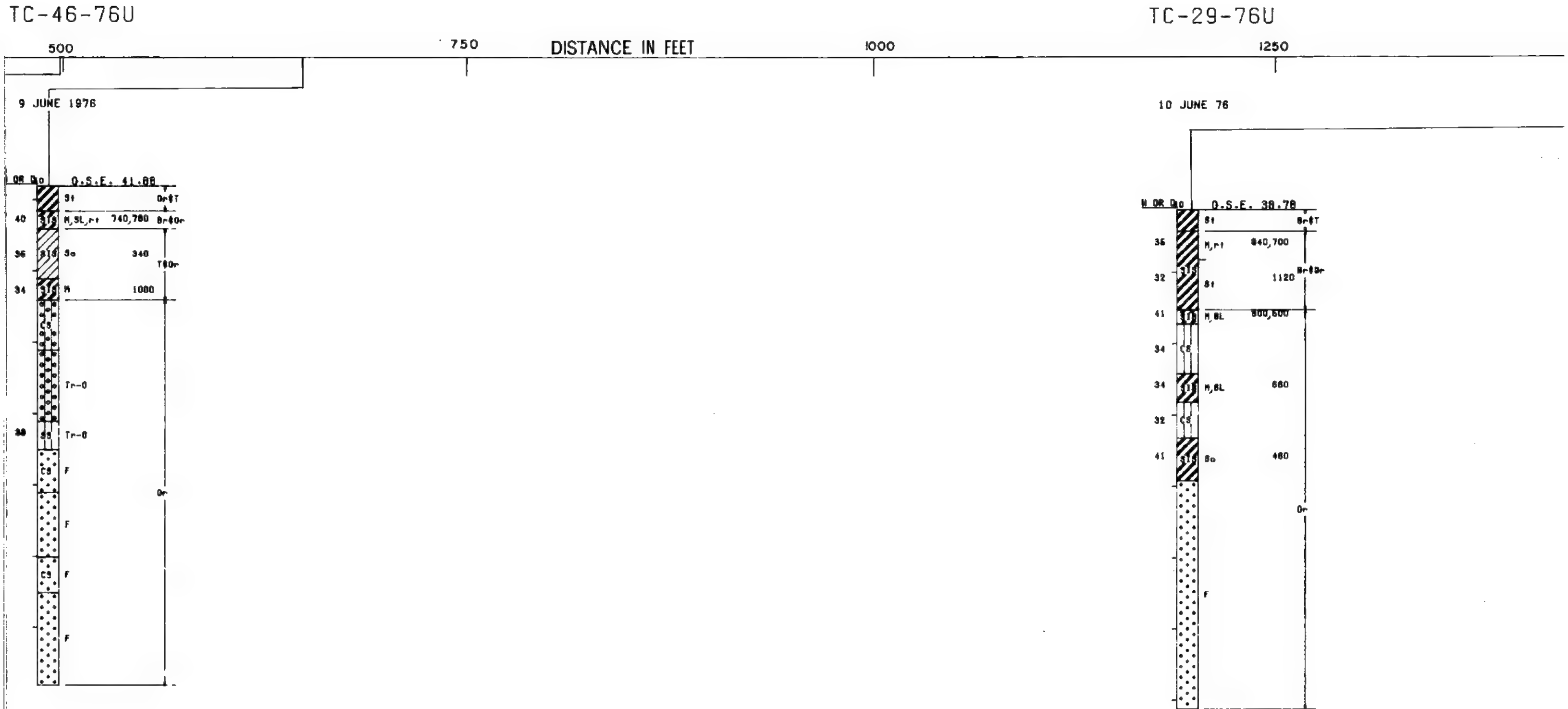
BORING PROFILE "E"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



TC-43-76U
TC-44-76U
TC-45-76U
TC-46-76U
0
250
500
8 JUNE 76
10 JUNE 76
9 JUNE 76
9 JUNE 1976
O.S.E. 40.15
O.S.E. 40.79
O.S.E. 45.71
O.S.E. 41.89
ELEVATIONS IN FEET N.G.V.D.
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170

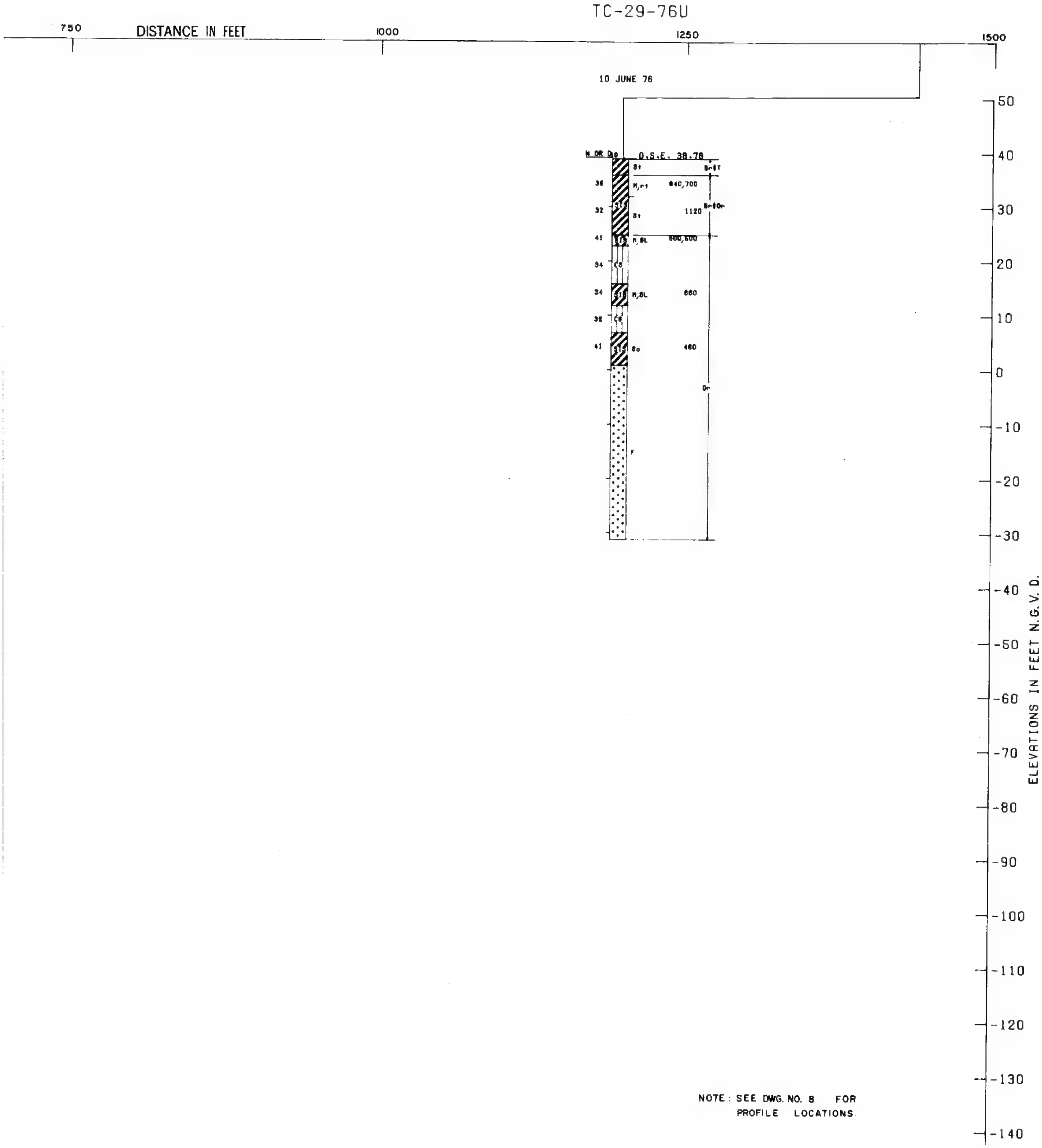
2



NOTE : SEE DWG. NO. 8 FOR PROFILE LOCATIONS.

BORINGS MADE BY EUSTIS ENGINEERING DURING JUNE 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. OR 3 IN. DIAMETER DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN BY VACUUM TYPE SHELBY TUBE METHOD WITH 5 IN. DIAMETER TUBE.

TENS
RED RIVER B
LO
TENSAS-COCODI
AND DRAINA
FOUNDA
BORING
SCAL
U. S. ARMY ENGINI
CORPS
VICKSBU
DATE: AUGUST 199



NOTE : SEE DWG. NO. 8 FOR PROFILE LOCATIONS.

BORINGS MADE BY EUSTIS ENGINEERING DURING JUNE 1976. GENERAL SAMPLES WERE TAKEN WITH 2.5 IN. OR 3 IN. DIAMETER DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN BY VACUUM TYPE SHELBY TUBE METHOD WITH 5 IN. DIAMETER TUBE.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

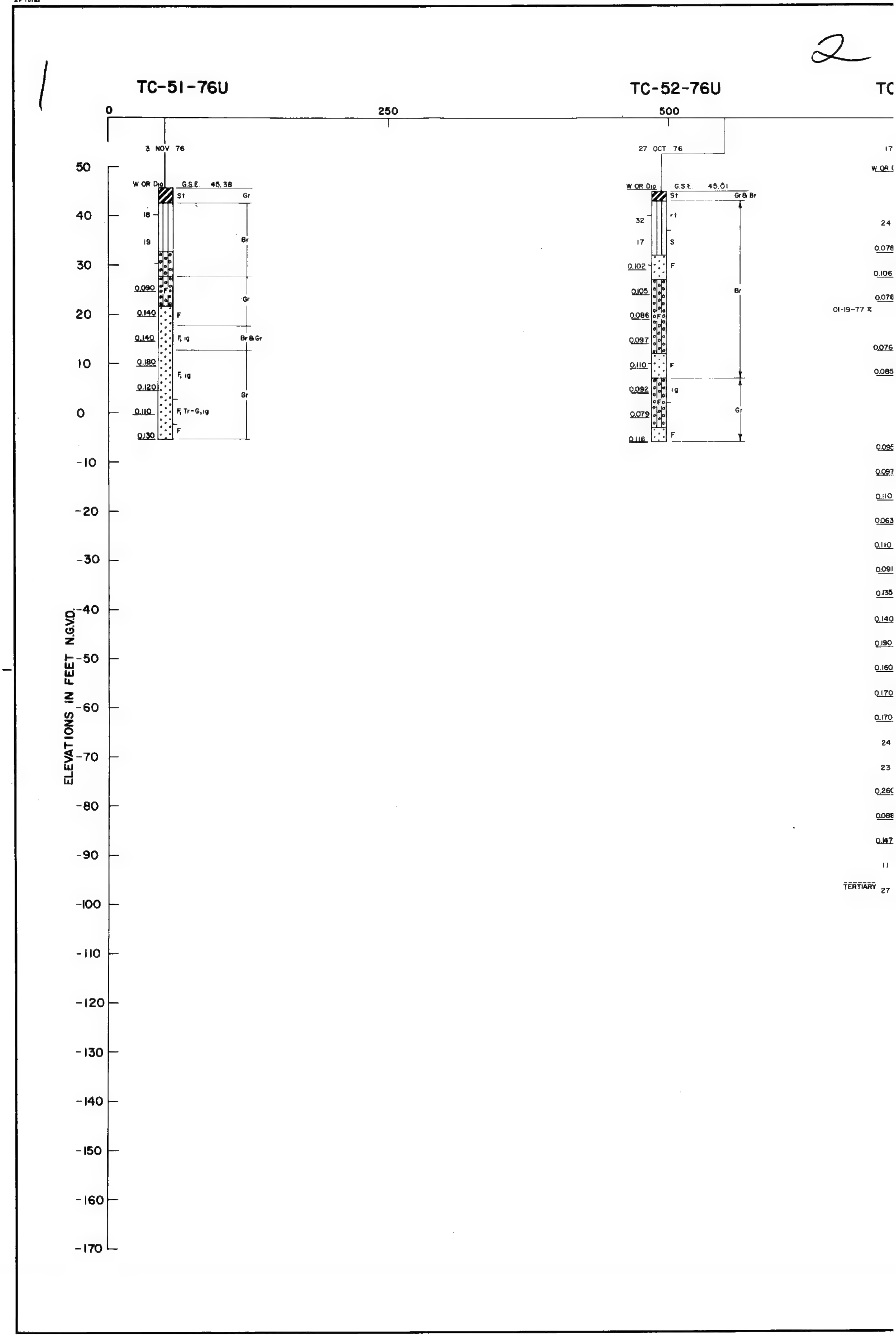
FOUNDATION REPORT

BORING PROFILE "F"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

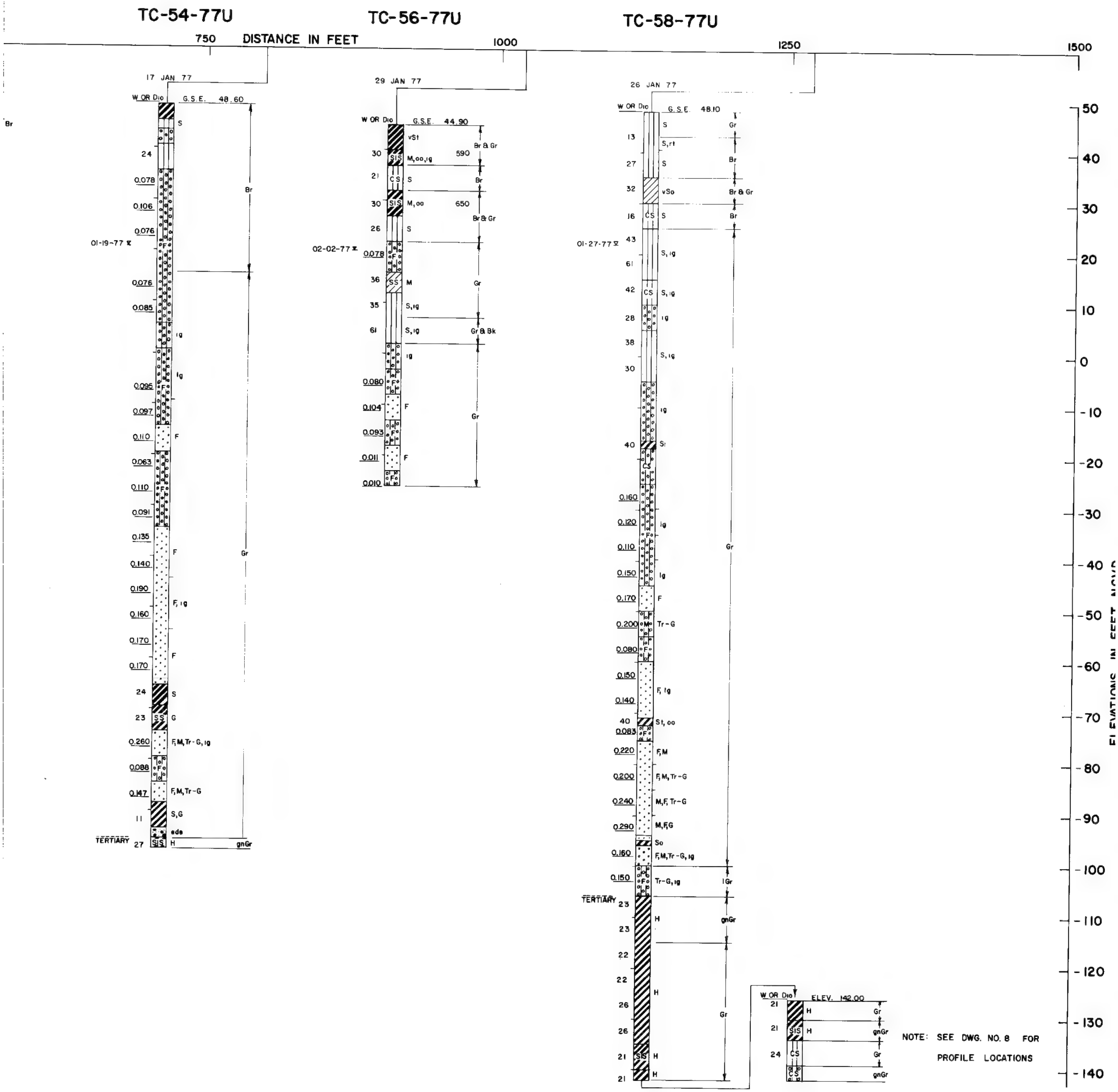
DATE: AUGUST 1996 FILE NO: T-14-37

AP 10182



CITY BLUEPRINT 12-75

2



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

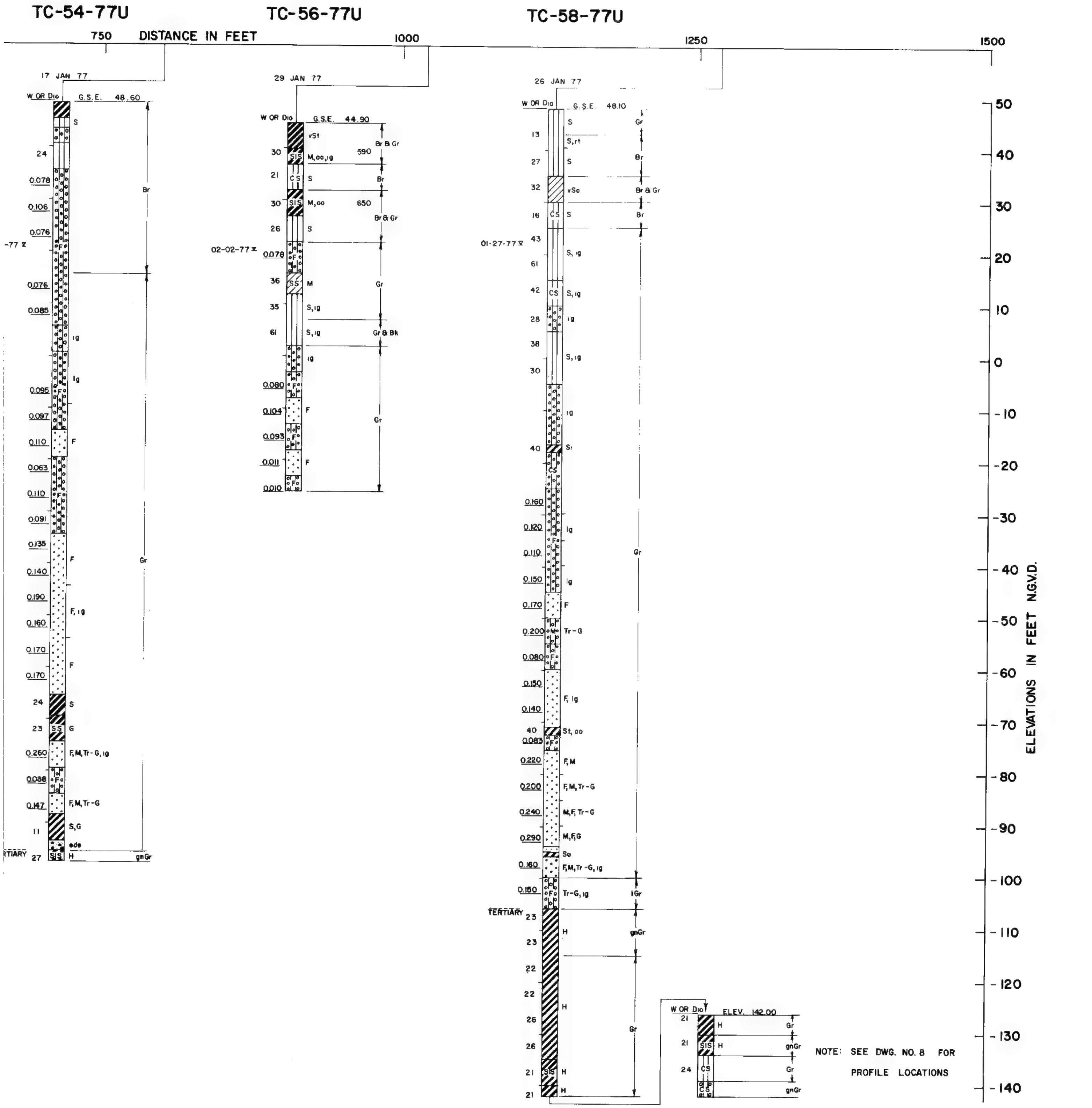
TENSAS-COCODRIE PUMPING P
AND DRAINAGE STRUCTUR

FOUNDATION REPORT

BORING PROFILE "G"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBUR
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO:

PL



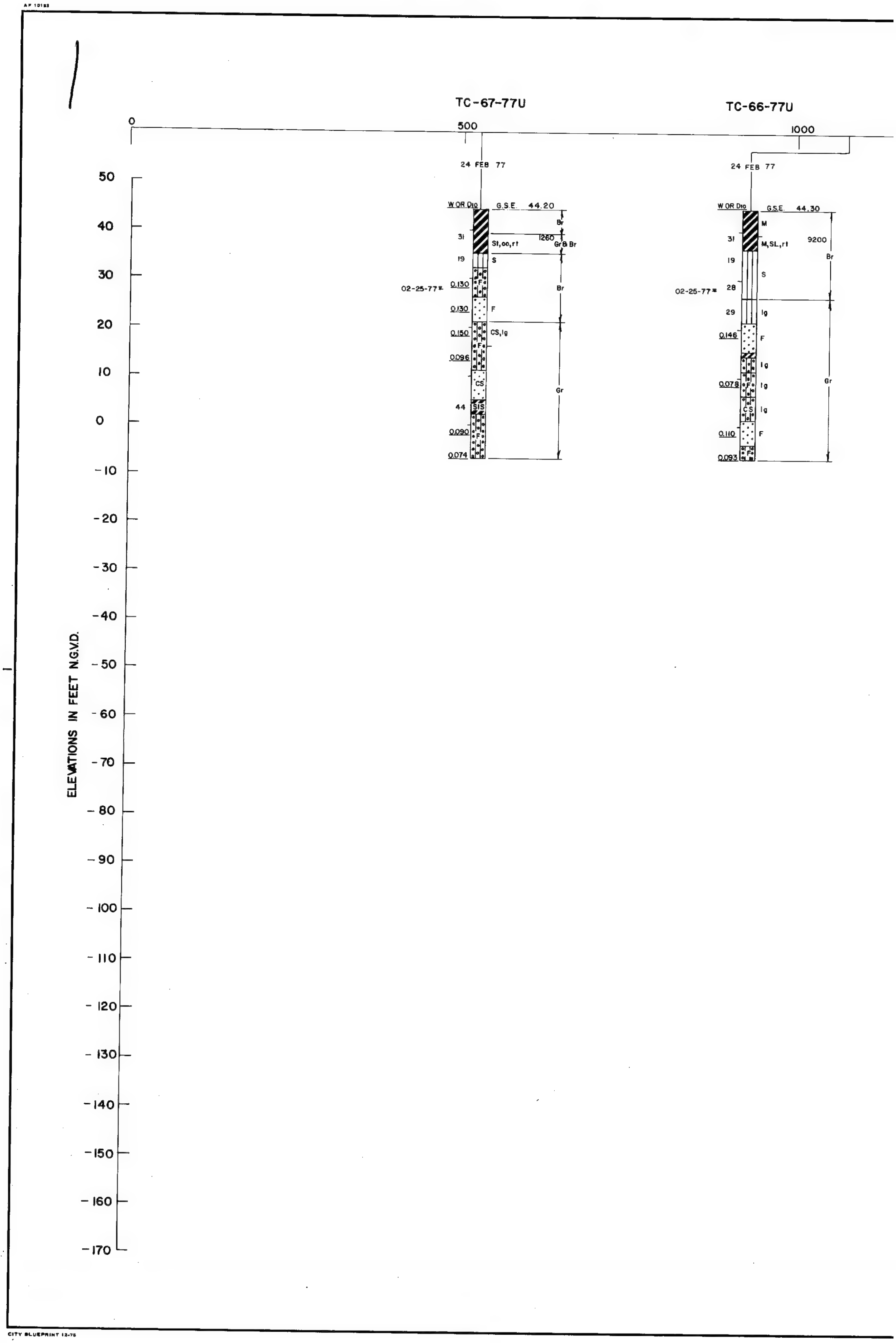
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

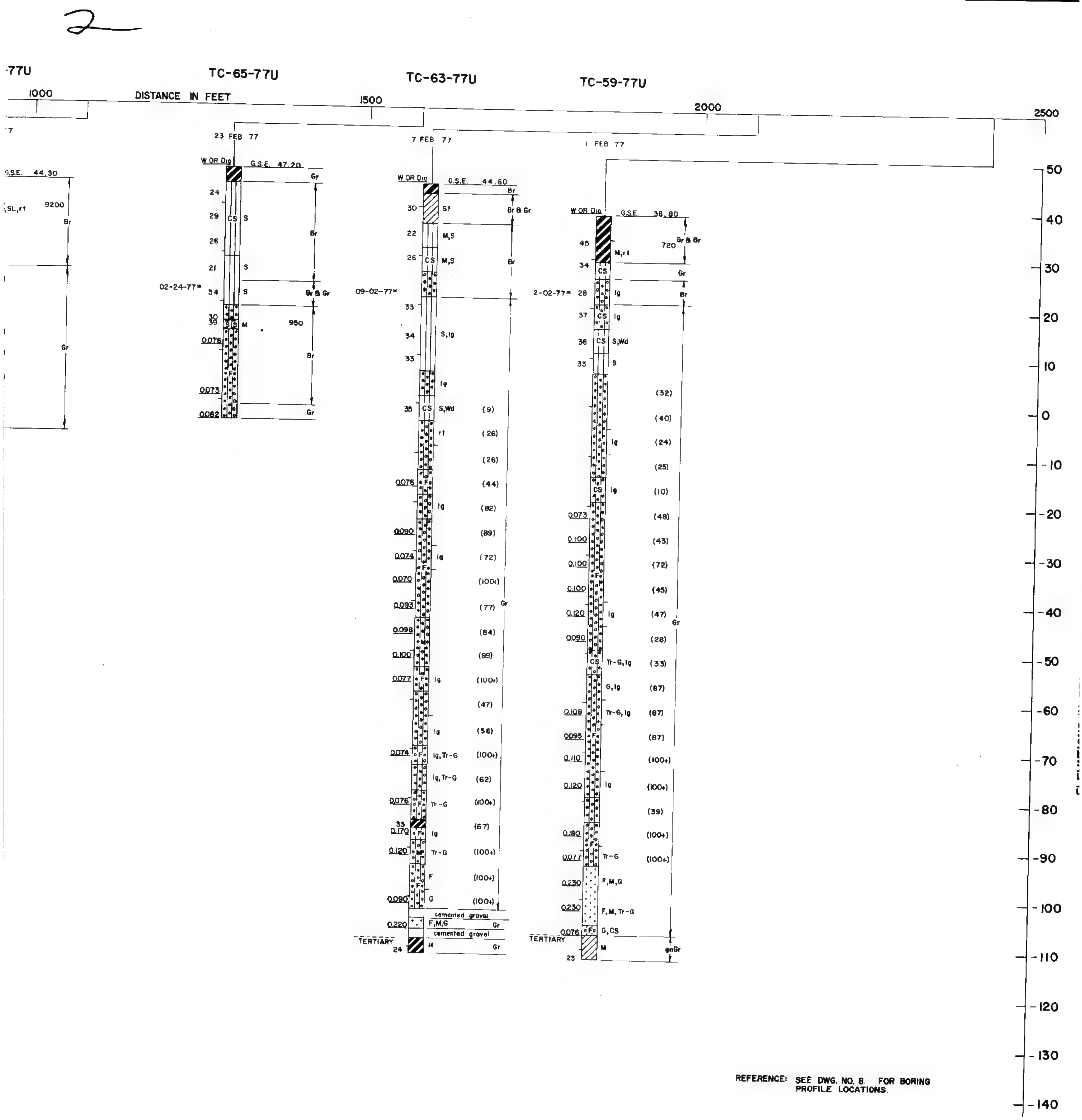
FOUNDATION REPORT

BORING PROFILE "G"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



AF 10183
TC-67-77U
TC-66-77U
0
500
1000
24 FEB 77
W OR D10
G.S.E. 44.20
G.S.E. 44.30
ELEVATIONS IN FEET N.G.V.D.
02-25-77
CITY BLUEPRINT 12-75



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING FEB 1977. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOKS 6113,6117,6119.

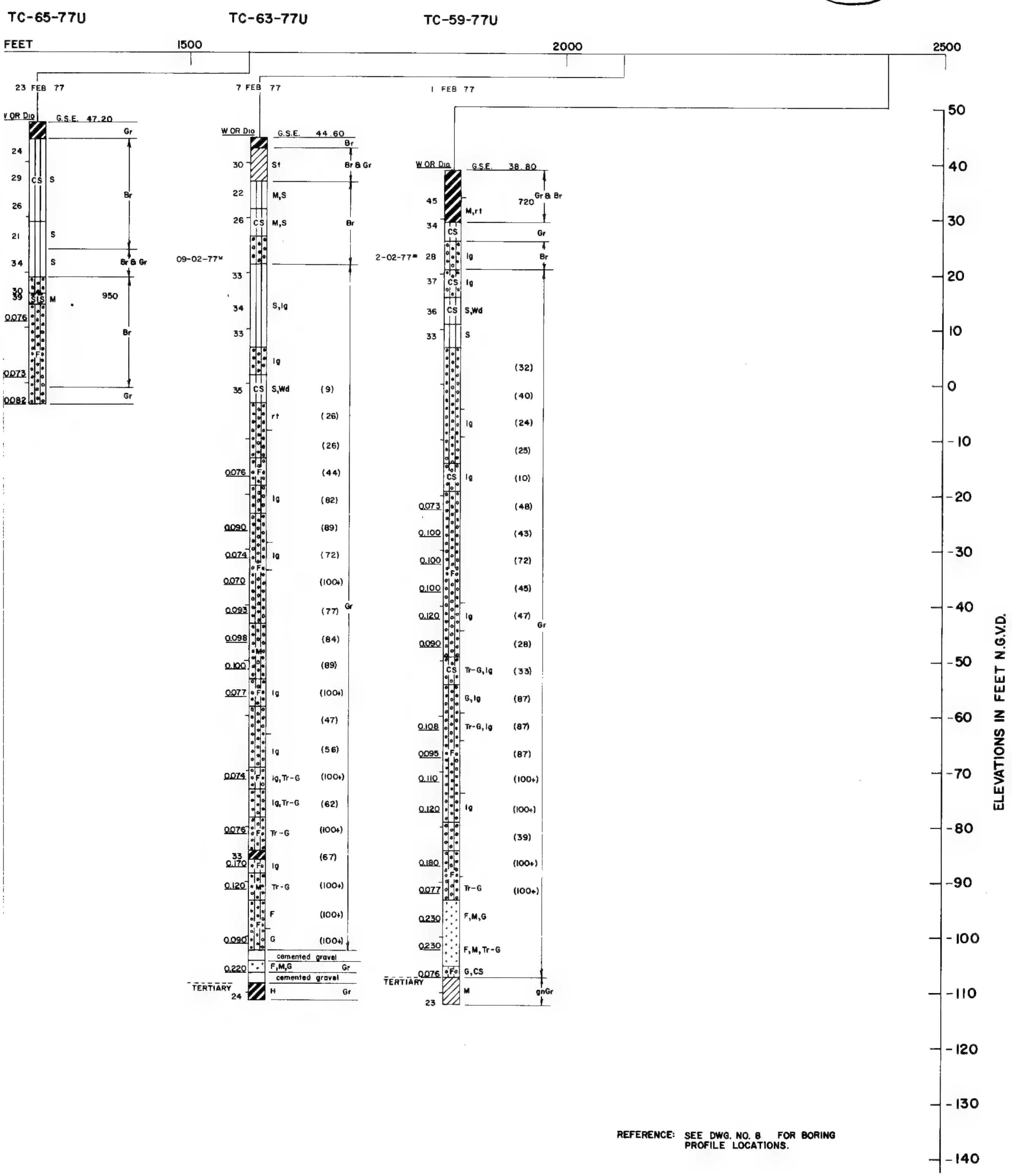
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLA
AND DRAINAGE STRUCTURE

FOUNDATION REPORT

BORING PROFILE "H"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING FEB 1977. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOKS 6113,6117,6119.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

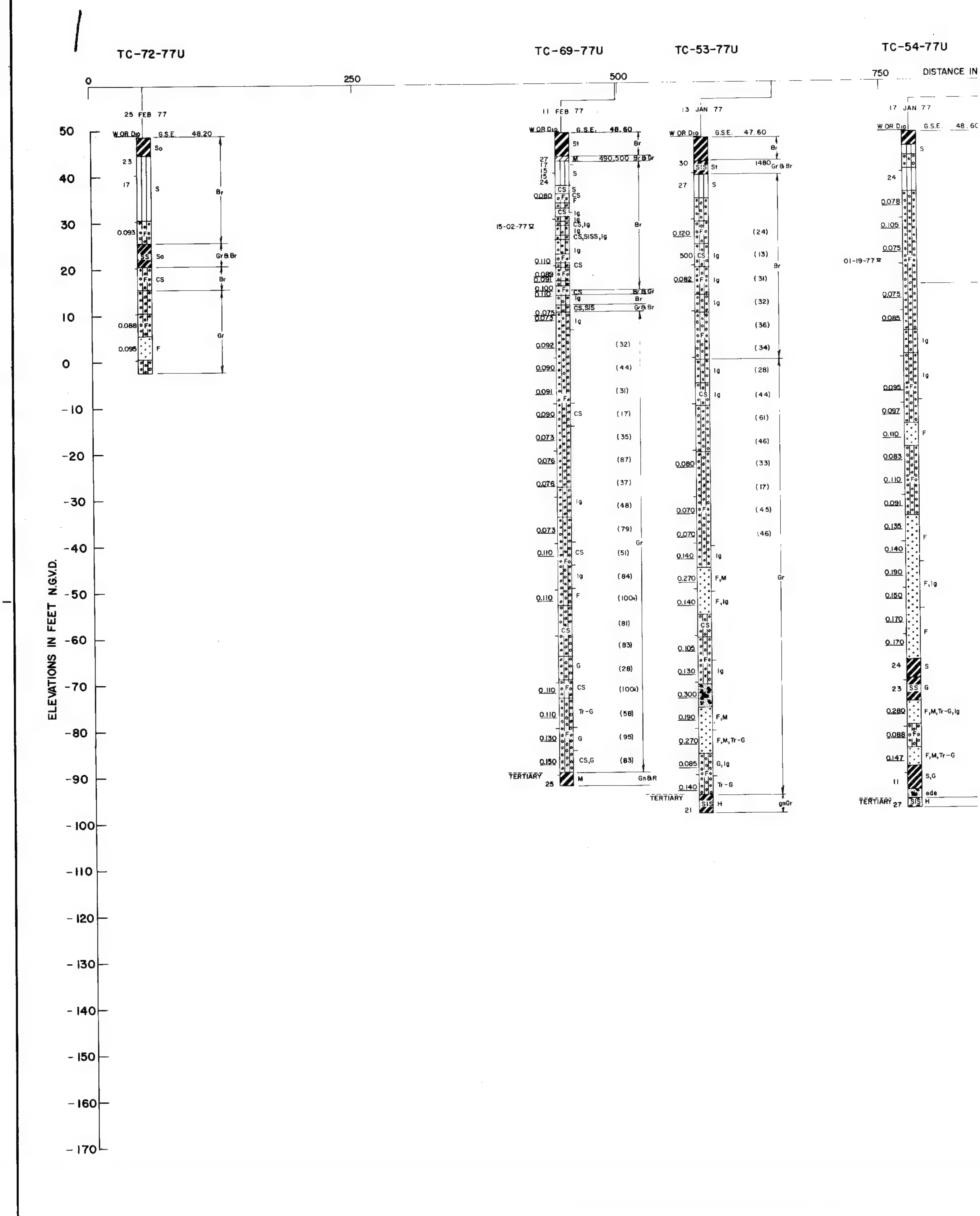
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

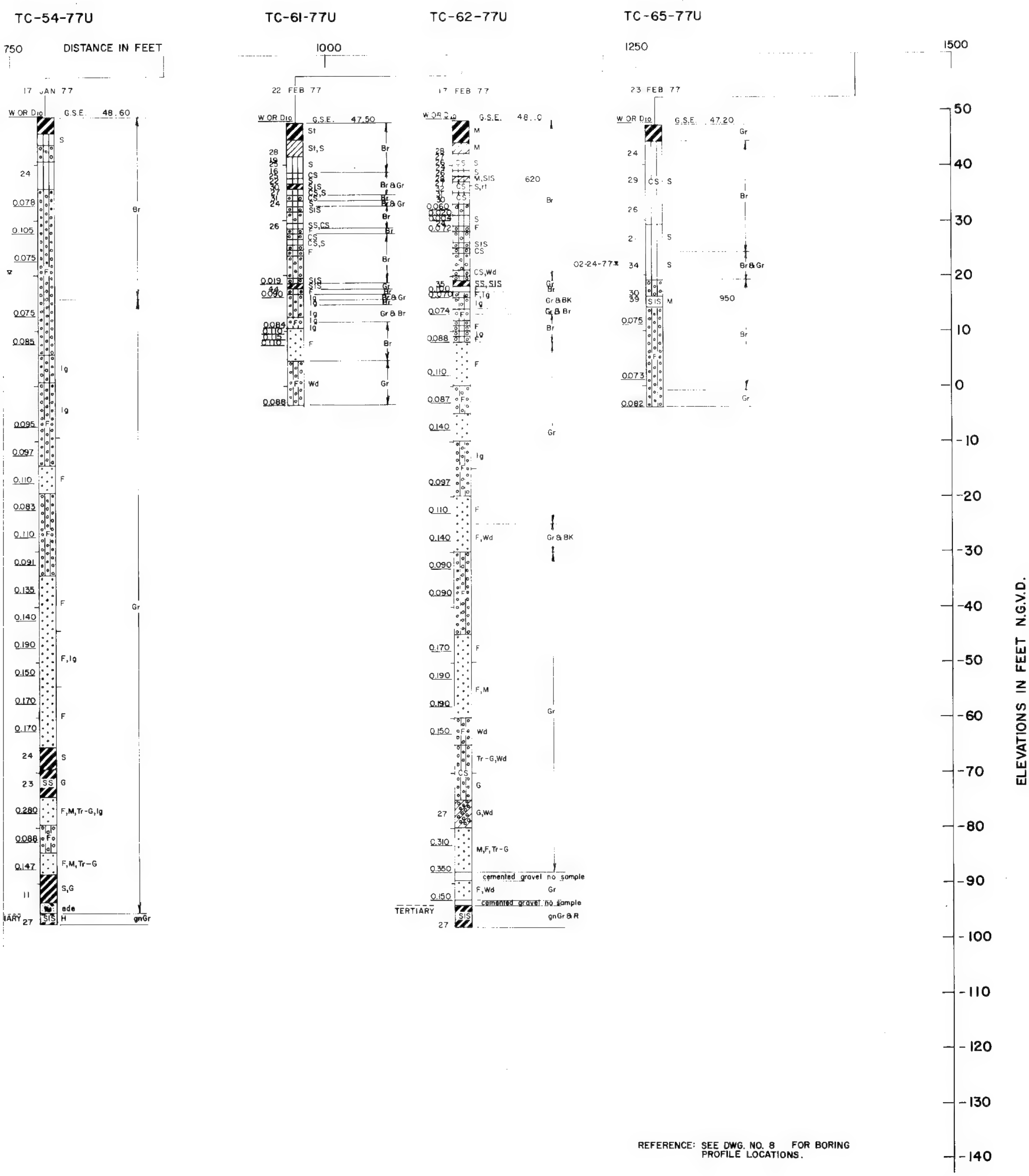
BORING PROFILE "H"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

AF 10188



TC-72-77U
TC-69-77U
TC-53-77U
TC-54-77U
DISTANCE IN
0
250
500
750
25 FEB 77
11 FEB 77
13 JAN 77
17 JAN 77
W OR D10
G.S.E. 48.20
G.S.E. 48.60
G.S.E. 47.60
G.S.E. 48.60
ELEVATIONS IN FEET N.G.V.D.
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
15-02-77
01-19-77
TERTIARY



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING JAN AND FEB 1977. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTUBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOKS 6106, 6113, 6117, 6119.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

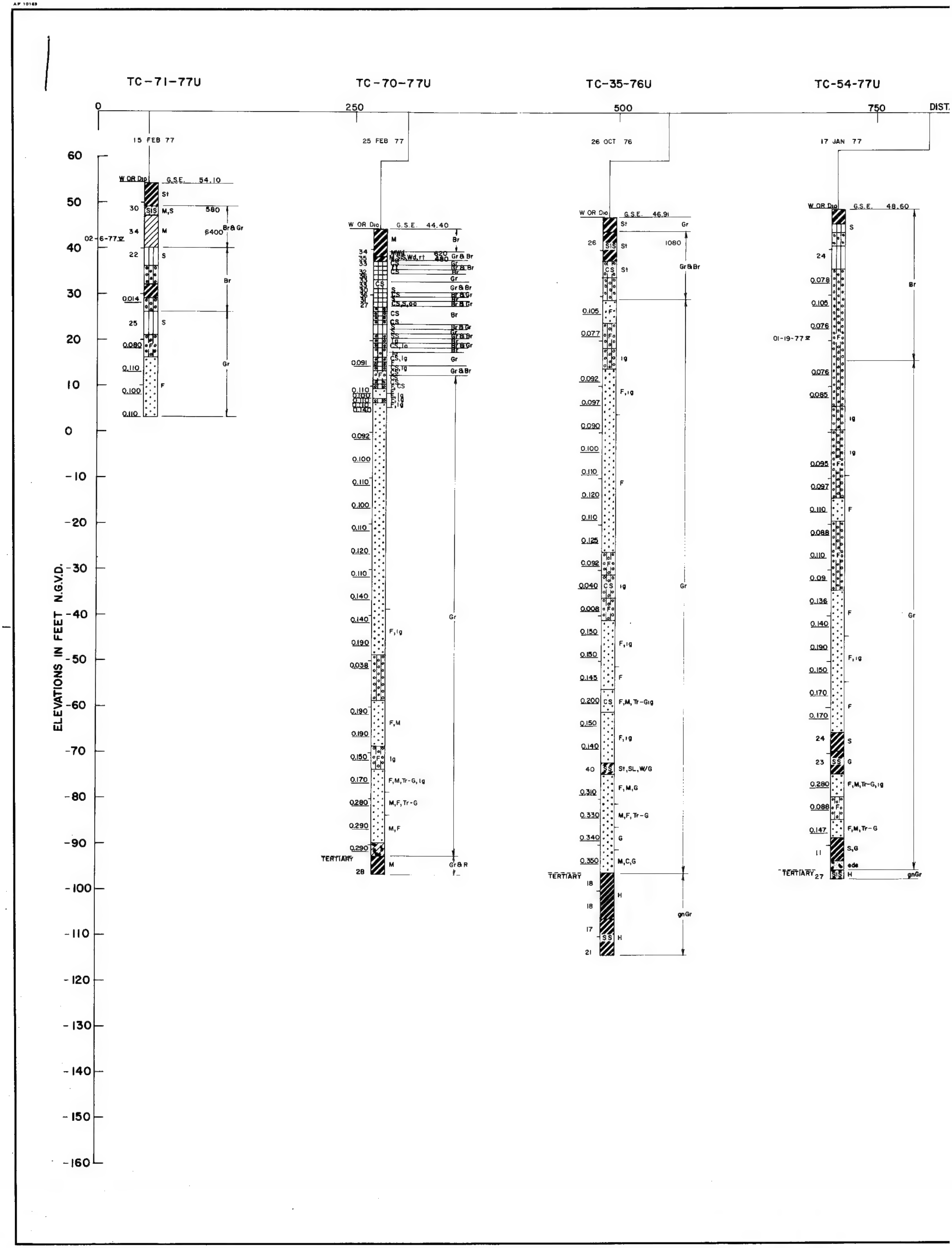
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

BORING PROFILE "I"

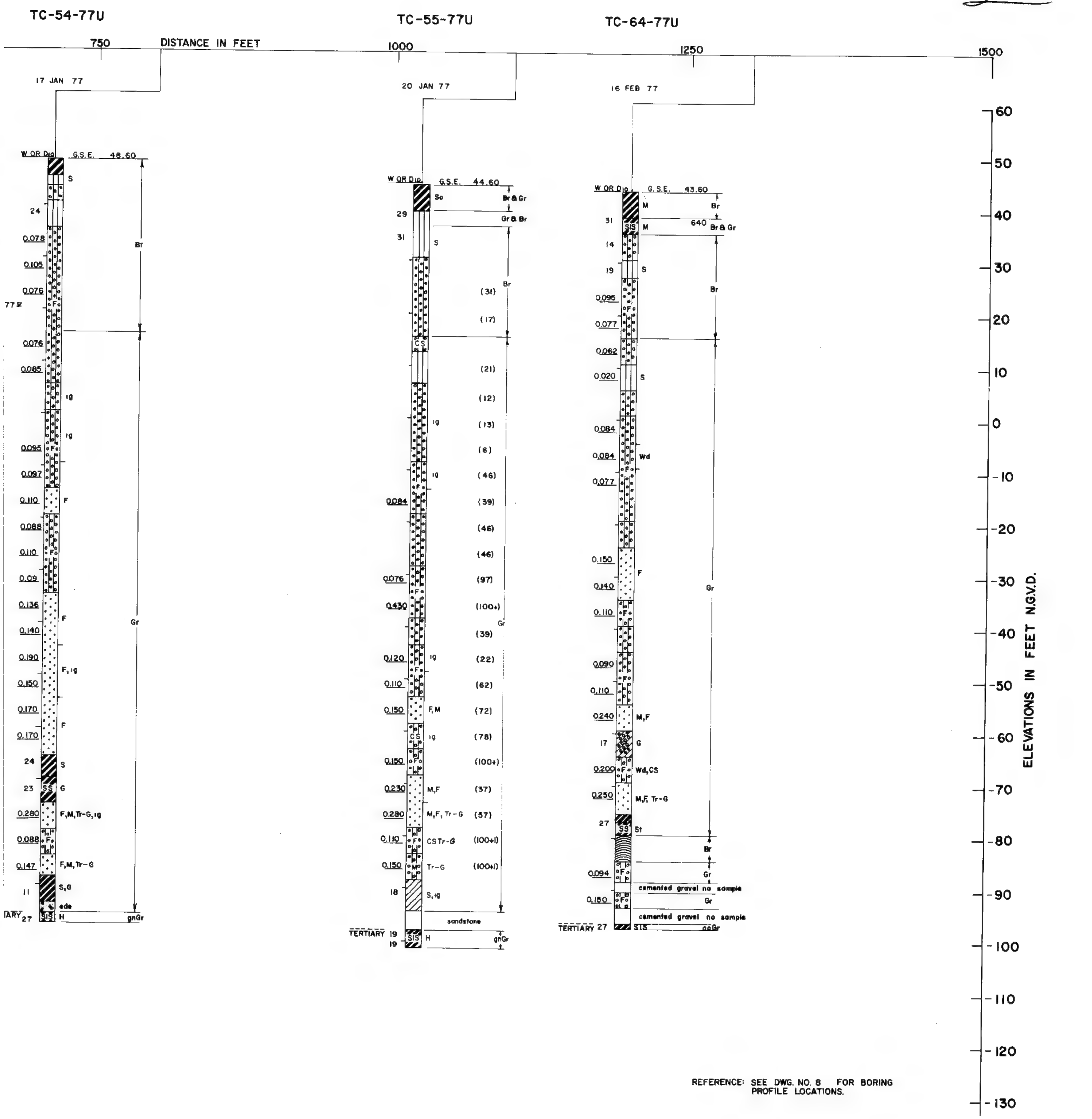
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



AF 10163
TC-71-77U
TC-70-77U
TC-35-76U
TC-54-77U
0
250
500
750
DIST.
15 FEB 77
25 FEB 77
26 OCT 76
17 JAN 77
G.S.E. 54.10
G.S.E. 44.40
G.S.E. 46.91
G.S.E. 48.60
W OR D10
02-16-77
01-19-77
TERTIARY
ELEVATIONS IN FEET N.G.V.D.
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
CITY BLUEPRINT 12-76

2



REFERENCE: SEE DWG. NO. 8 FOR BORING PROFILE LOCATIONS.

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING OCT 1976, JAN,FEB 1977. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BOR BKS 6085,6106,6117,6119.

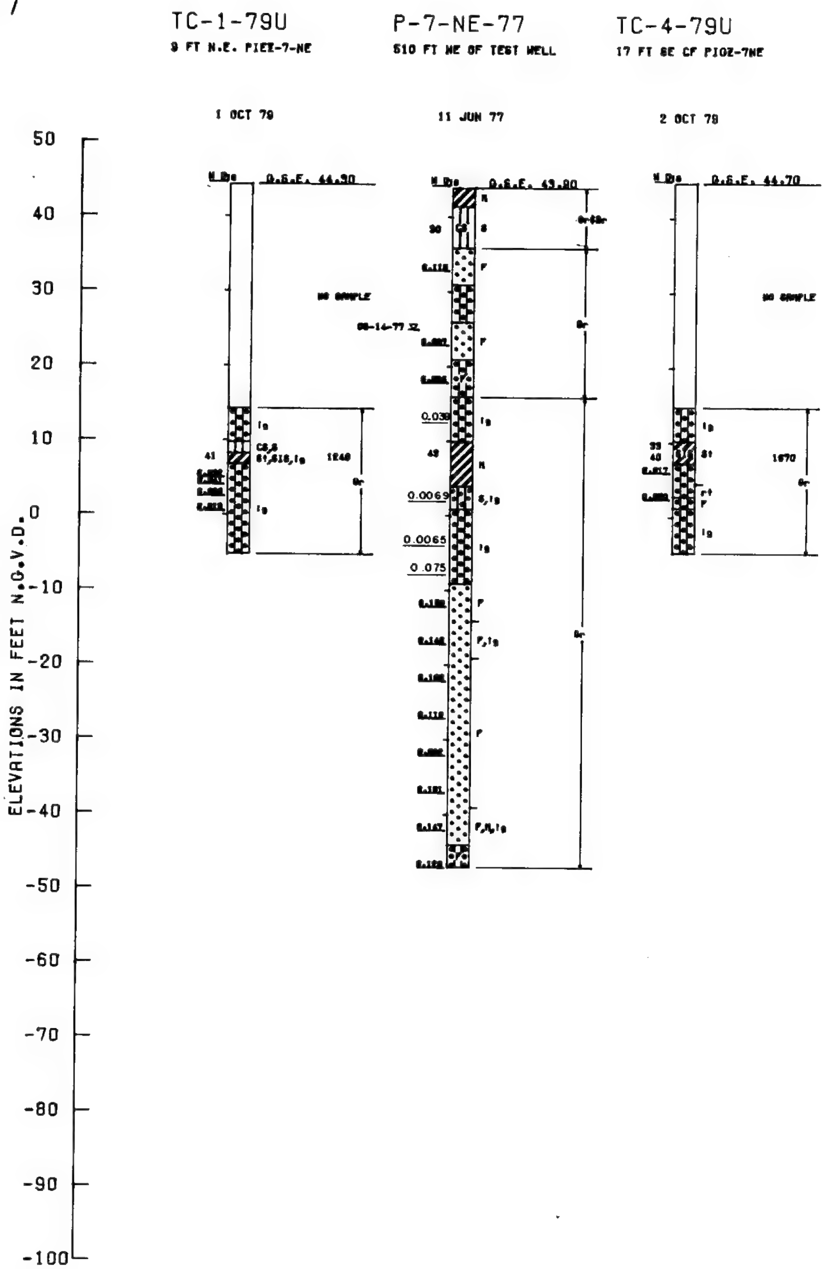
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

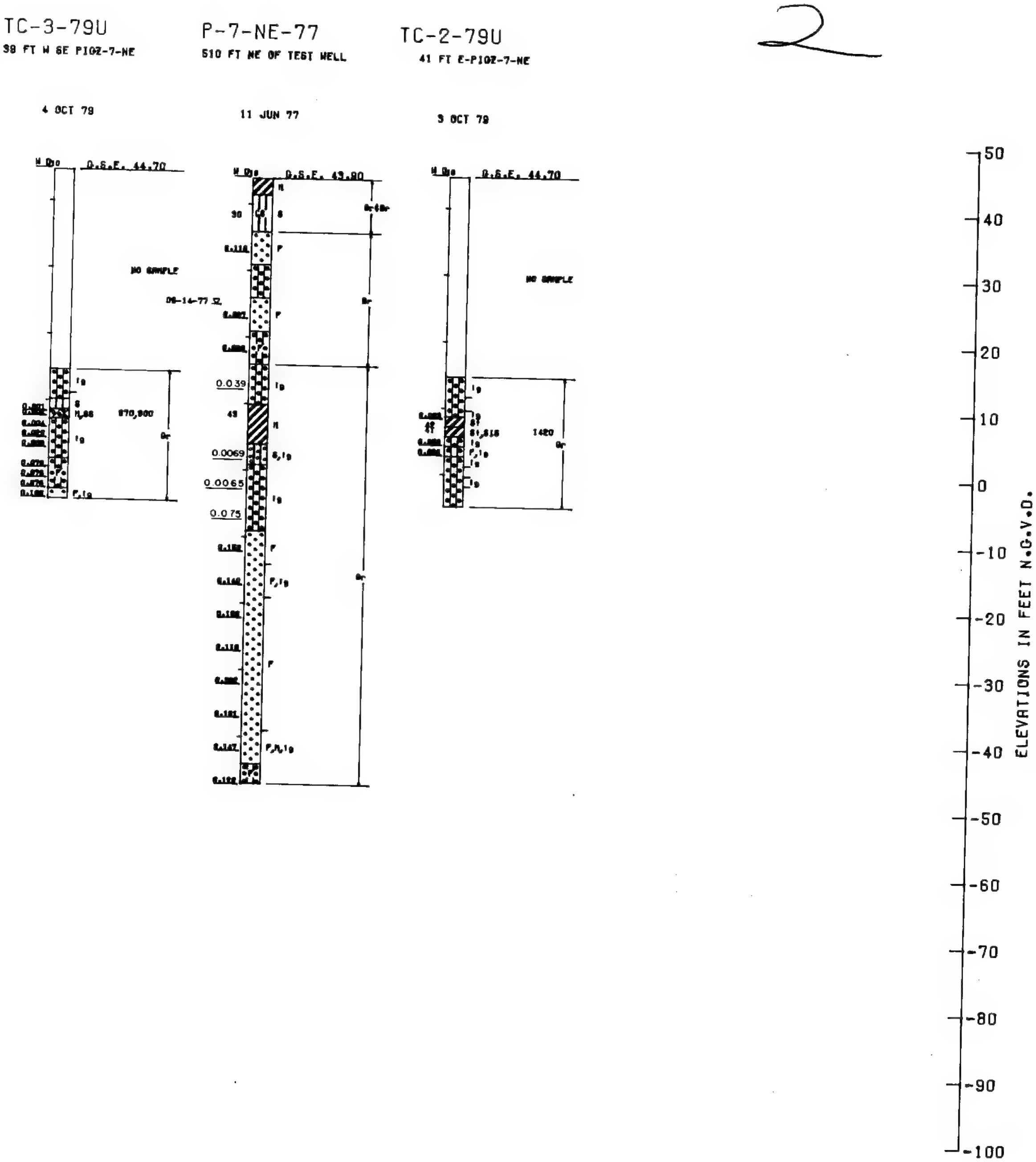
FOUNDATION REPORT

BORING PROFILE "J"

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



TC-1-79U
9 FT N.E. PIEZ-7-NE
P-7-NE-77
510 FT NE OF TEST WELL
TC-4-79U
17 FT SE OF PIOZ-7NE
1 OCT 79
11 JUN 77
2 OCT 79
G.S.E. 44.30
G.S.E. 43.80
G.S.E. 44.70
NO SAMPLE
NO SAMPLE
1240
1870
0.039
0.0069
0.0065
0.075
ELEVATIONS IN FEET N.G.V.D.
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100



NOTE:
LOCATION OF TC-1-2-3-4-79U SHOWN ON PLATE 8
LOCATION OF P-7-NE-77 NOT SHOWN

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING JUN 1977 AND OCT 1979. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN VACUUM TUBE. BORING BOOKS 6150, 6405.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

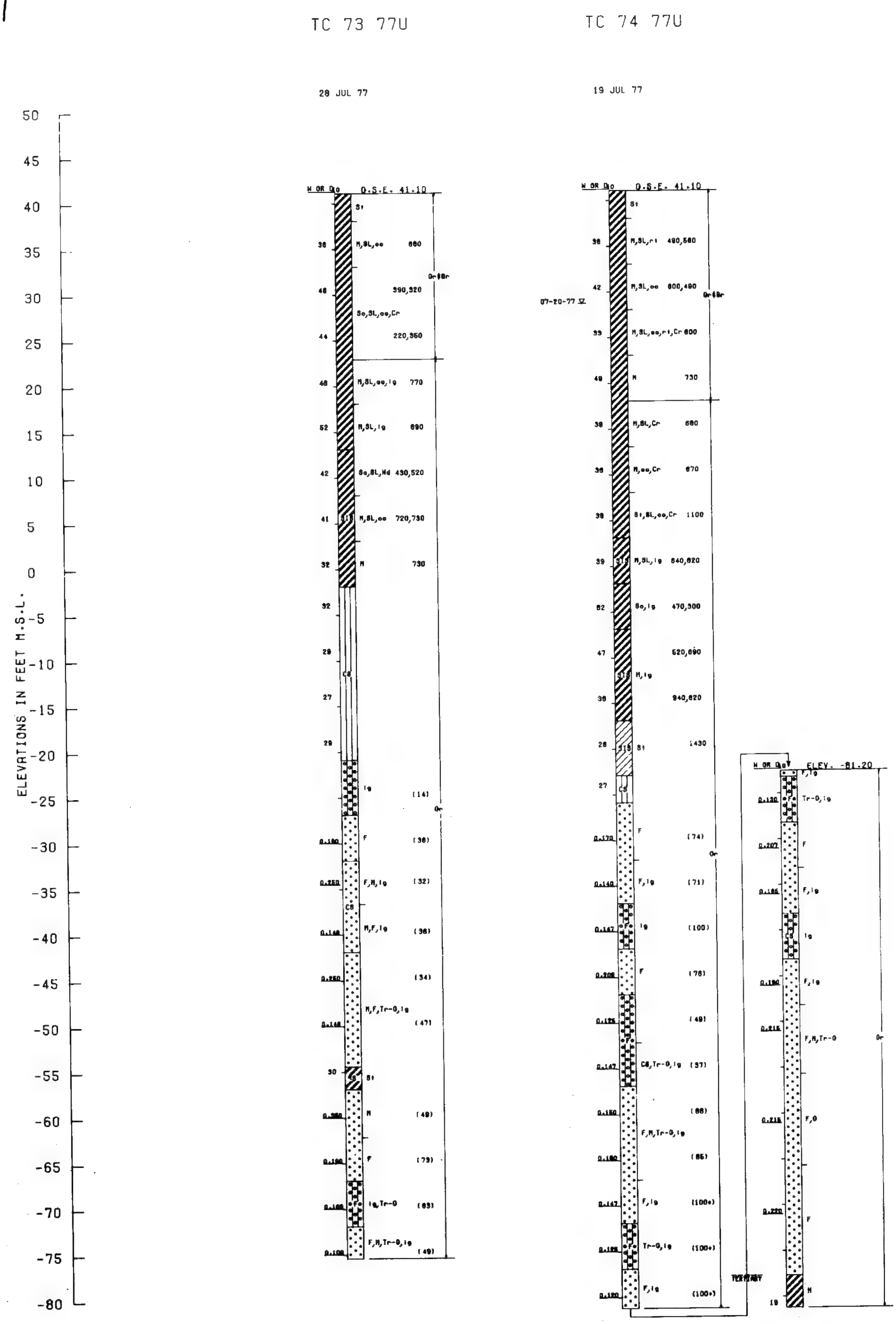
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

BORING PROFILE
BENEATH INLET SLAB

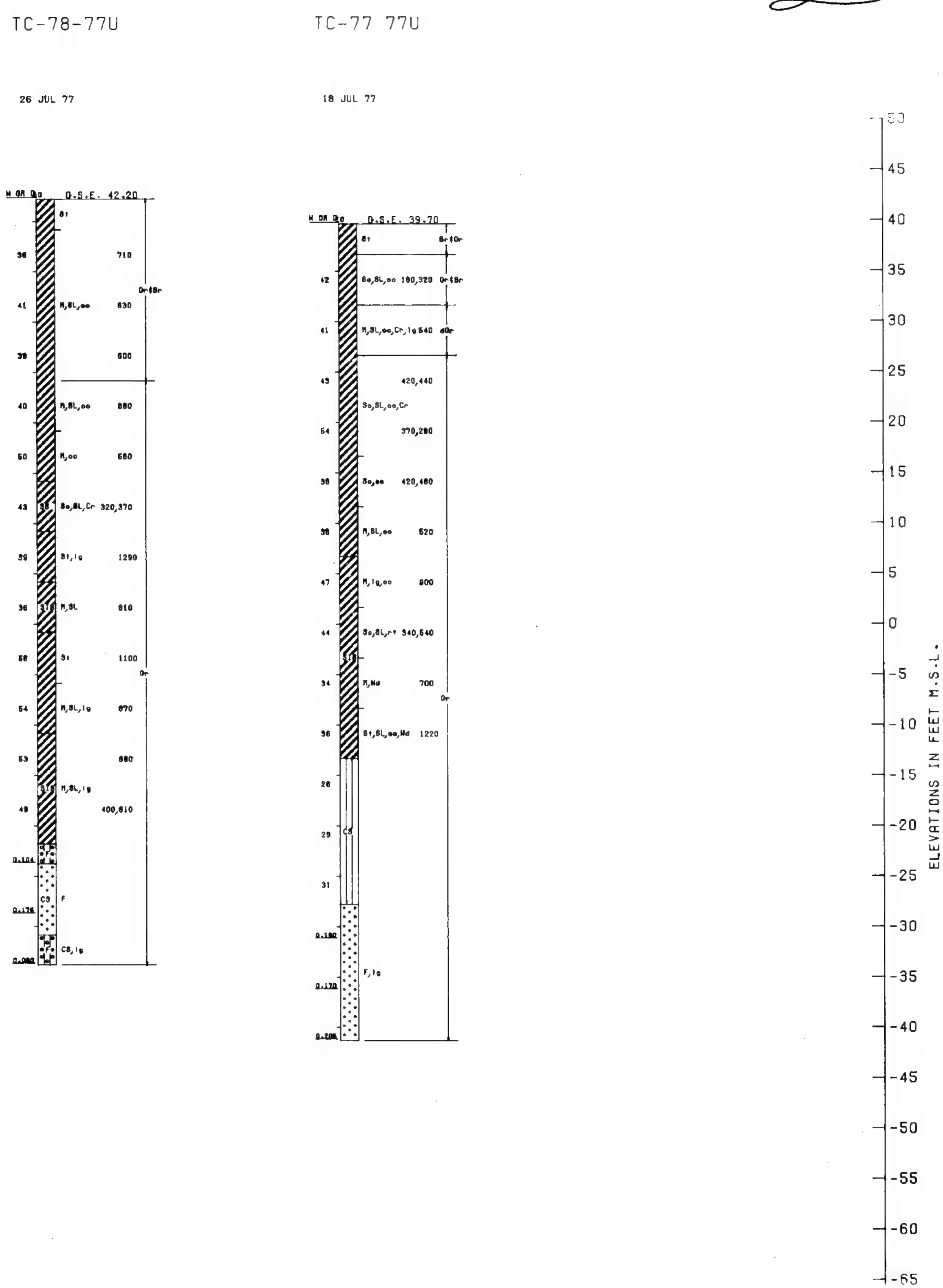
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1995 FILE NO: T-14-37



TC 73 77U
28 JUL 77
TC 74 77U
19 JUL 77
ELEVATIONS IN FEET M.S.L.
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-60
-65
-70
-75
-80
G.S.E. 41.10
G.S.E. 41.10
07-20-77
ELEV. -61.20
TERTIARY

2



NOTE:
FOR LOCATION OF BORINGS SEE DRAWING 5

BORINGS MADE BY ROTARY DRILLING METHOD W/MUD DURING JULY 1977. GENERAL SAMPLES WERE TAKEN WITH A 2.5 IN. DRIVE TUBE. UNDISTURBED SAMPLES WERE TAKEN WITH A 5 IN. VACUUM TUBE. BORING BOOK 6161

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

UPPER WEIR SOIL BORINGS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		TYPE	LETTER SYMBOL	SYMBOL	TYPICAL NAMES
COARSE - GRAINED SOILS More than half of material is larger than No. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.	CLEAN GRAVEL (Little or No Fines)	GW		GRAVEL, Well Graded, gravel-sand mixtures, little or no fines
			GP		GRAVEL, Poorly Graded, gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES (Appreciable Amount of Fines)	GM		SILTY GRAVEL, gravel-sand-silt mixtures
			GC		CLAYEY GRAVEL, gravel-sand-clay mixtures
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SAND (Little or No Fines)	SW		SAND, Well-Graded, gravelly sands
			SP		SAND, Poorly-Graded, gravelly sands
		SANDS WITH FINES (Appreciable Amount of Fines)	SM		SILTY SAND, sand-silt mixtures
			SC		CLAYEY SAND, sand-clay mixtures
FINE - GRAINED SOILS More than half the material is smaller than No. 200 sieve size.		SILTS AND CLAYS (Liquid Limit <50)	ML		SILT & very fine sand, silty or clayey fine sand or clayey silt with slight plasticity
			CL		LEAN CLAY, Sandy Clay, Silty Clay, of low to medium plasticity
			OL		ORGANIC SILTS and organic silty clays of low plasticity
		SILTS AND CLAYS (Liquid Limit >50)	MH		SILT, fine sandy or silty soil with high plasticity
			CH		FAT CLAY, inorganic clay of high plasticity
			OH		ORGANIC CLAYS of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt		PEAT, and other highly organic soil
WOOD			Wd		WOOD
SHELLS			Sl		SHELLS
NO SAMPLE					

NOTE: Soils possessing characteristics of two groups are designated by combinations of group symbols
A comma will be used between modification symbols. Example: So, Gr, w/SS, SIS, (CH)

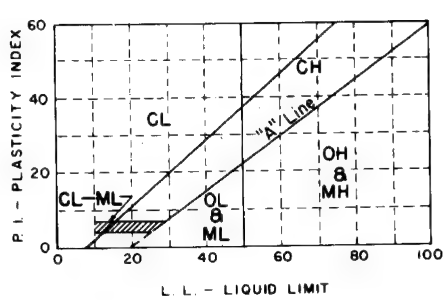
DESCRIPTIVE SYMBOLS

COLOR

COLOR	SYMBOL
TAN	T
YELLOW	Y
RED	R
BLACK	BK
GRAY	Gr
LIGHT GRAY	lGr
DARK GRAY	dGr
BROWN	Br
LIGHT BROWN	lBr
DARK BROWN	dBr
BROWNISH - GRAY	br Gr
GRAYISH - BROWN	gy Br
GREENISH - GRAY	gn Gr
GRAYISH - GREEN	gy Gn
GREEN	Gn
BLUE	Bl
BLUE - GREEN	Bl Gn
WHITE	Wh
MOTTLED	Mot

CONSISTENCY FOR COHESIVE SOILS

CONSISTENCY	COHESION IN LBS./SQ. FT. FROM UNCONFINED COMPRESSION TEST	SYMBOL
VERY SOFT	< 250	vSo
SOFT	250 - 500	So
MEDIUM	500 - 1000	M
STIFF	1000 - 2000	St
VERY STIFF	2000 - 4000	vSt
HARD	> 4000	H



PLASTICITY CHART
For classification of fine-grained soils

MODIFICATIONS

MODIFICATION	SYMBOL
Traces	Tr-
Fine	F
Medium	M
Coarse	C
Concretions	cc
Rootlets	rt
Lignite fragments	lg
Shale fragments	sh
Sandstone fragments	sds
Shell fragments	slf
Organic matter	O
Clay strata or lenses	CS
Silt strata or lenses	SIS
Sand strata or lenses	SS
Sandy	S
Gravelly	G
Boulders	B
Slickensides	SL
Wood	Wd
Oxidized	Ox
Crumbly	Cr
Loose	Lo
Vegetation	Veg
Sandy Silt Strata	SSIS
Silty Sand Strata	SISS
With	w/
Dense	D
Very Dense	vD

2

NOTES:

FIGURES TO LEFT OF BORING UNDER COLUMN "W OR D_{10}"
Are natural water contents in percent dry weight
When underlined denotes D_{10} size in mm*
FIGURES TO LEFT OF BORING UNDER COLUMNS "LL" AND "PL"
Are liquid and plastic limits, respectively
SYMBOLS TO LEFT OF BORING
$\underline{\nabla}$ Ground-water surface and date observed
(C) Denotes location of consolidation test**
(S) Denotes location of consolidated-drained direct shear test**
(R) Denotes location of consolidated-undrained triaxial compression test**
(Q) Denotes location of unconsolidated-undrained triaxial compression test**
(T) Denotes location of sample subjected to consolidation test and each of the above three types of shear tests**
FW Denotes free water encountered in boring or sample
FIGURES TO RIGHT OF BORING
Are values of cohesion in lbs./sq. ft. from unconfined compression tests
In parenthesis are driving resistances in blows per foot determined with a standard split spoon sampler ($1\frac{3}{8}$" I. D., 2" O. D.) and a 140 lb. driving hammer with a 30" drop
Where underlined with a solid line denotes laboratory permeability in centimeters per second of undisturbed sample
Where underlined with a dashed line denotes laboratory permeability in centimeters per second of sample remoulded to the estimated natural void ratio

*The D_{10} size of a soil is the grain diameter in millimeters of which 10% of the soil is finer, and 90% coarser than D_{10}

**Results of these tests are available for inspection in the U. S. Army Engineer District Office, if these symbols appear beside the boring logs on the drawings

TYPICAL NOTES:

While the borings are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and, if encountered, such variations will not be considered as differing materially within the purview of clause 4 of the contract.

Ground-water elevations shown on the boring logs represents ground-water surfaces encountered on the dates shown. Absence of water surface data on certain borings implies that no ground-water data is available, but does not necessarily mean that ground water will not be encountered at the locations or within the vertical reaches of these borings.

Consistency of cohesive soils shown on the boring logs is based on driller's log and visual examination and is approximate, except within those vertical reaches of the borings where shear strengths from unconfined compression tests are shown.

† **The detailed explanation of the Unified Soil Classification System is presented in MIL-STD-619B, 12 June 1968, entitled "Military Standard Unified Soil Classification System for Roads, Airfields, Embankments and Foundations."**

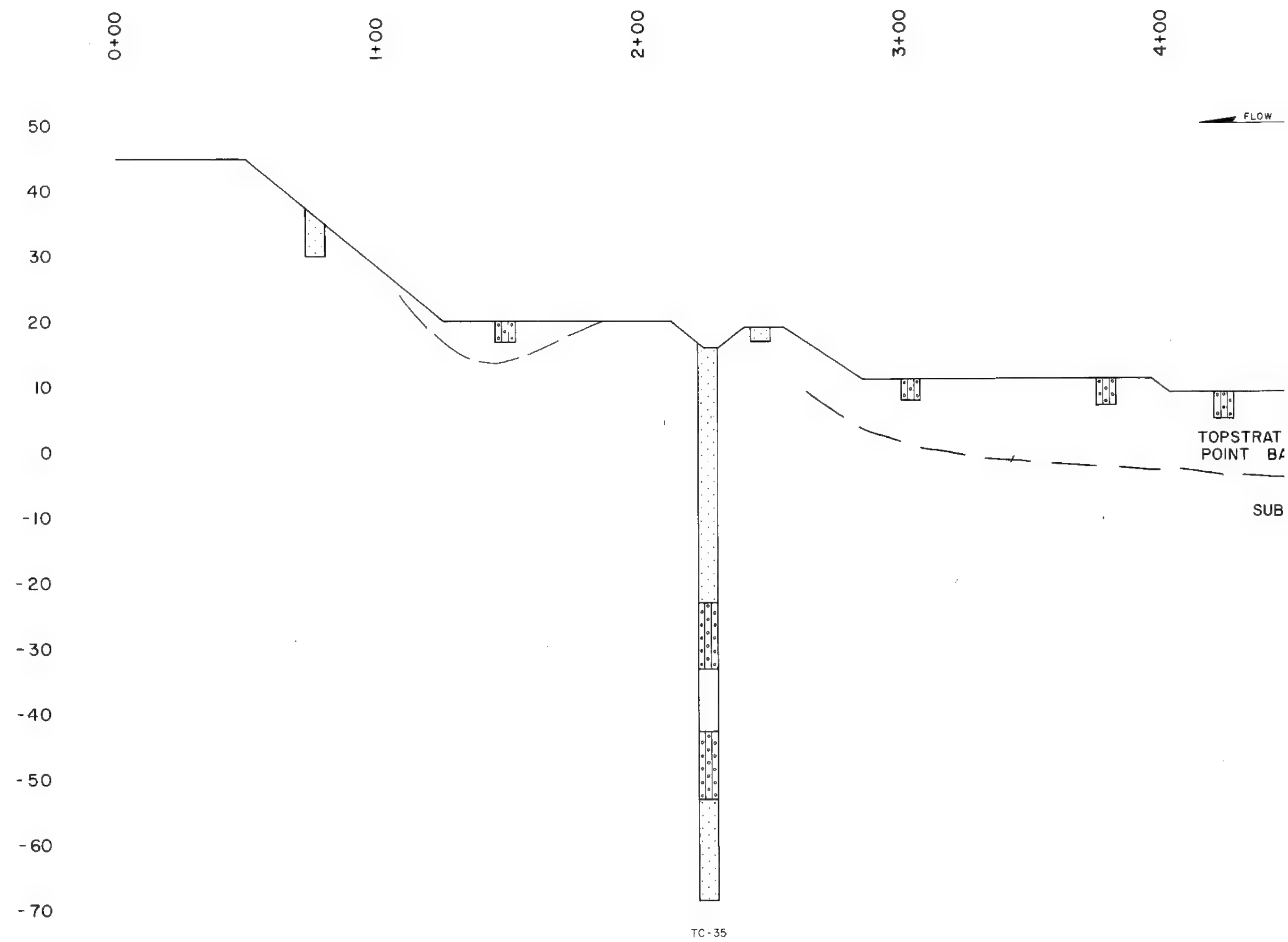
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

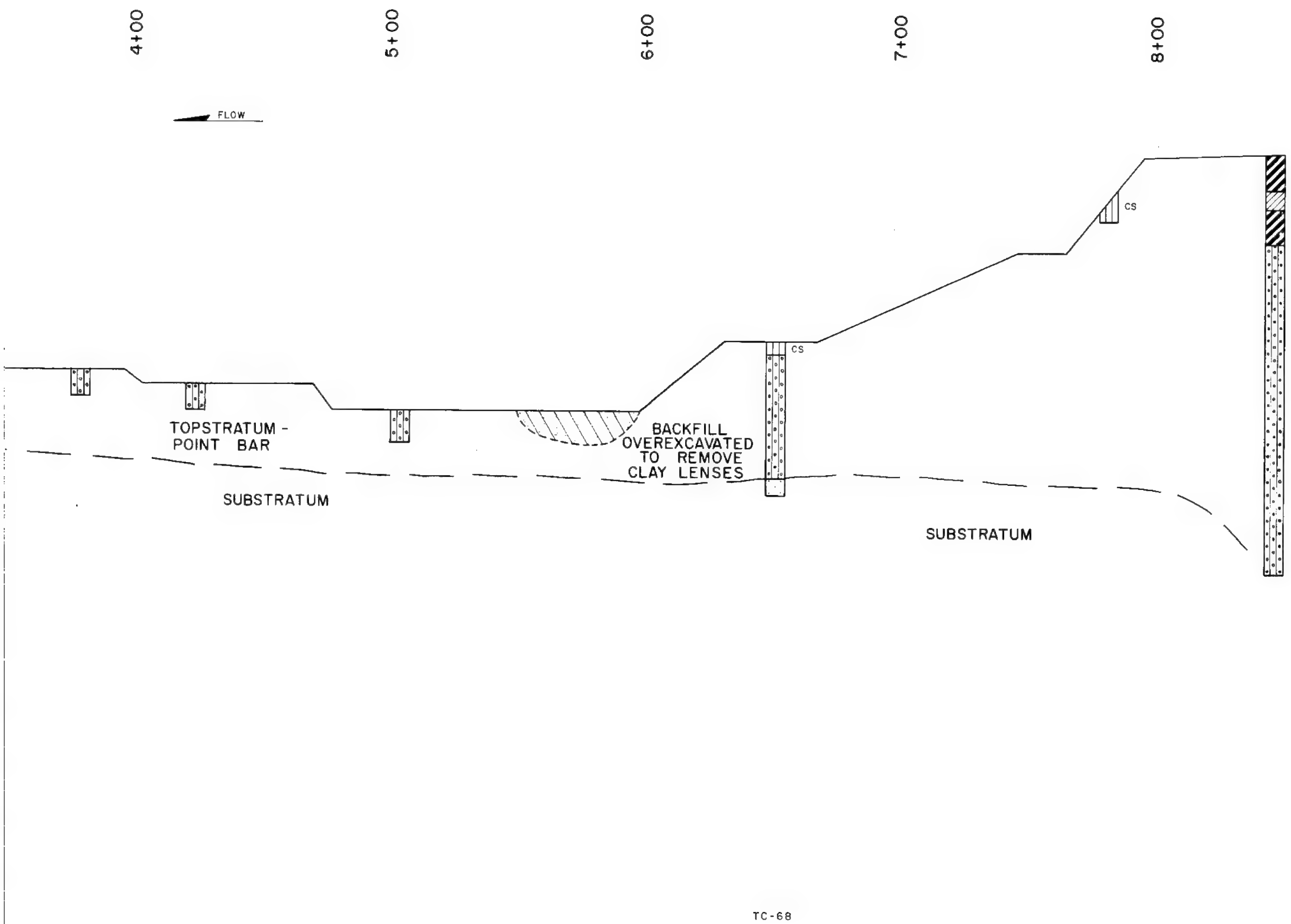
SOIL BORING LEGEND

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



0+00
1+00
2+00
3+00
4+00
FLOW
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
TC-35
TOPSTRAT
POINT BA
SUB

2



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

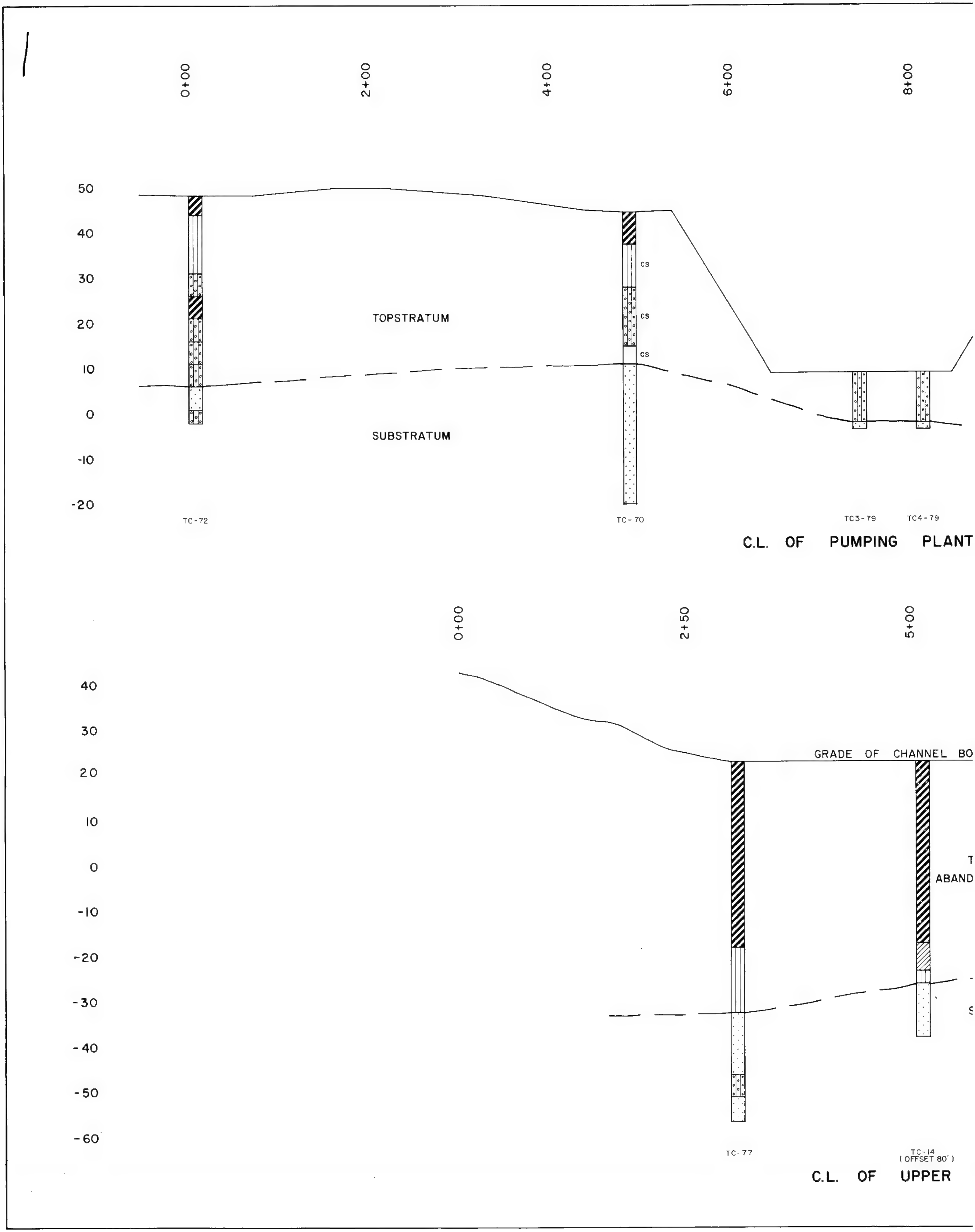
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

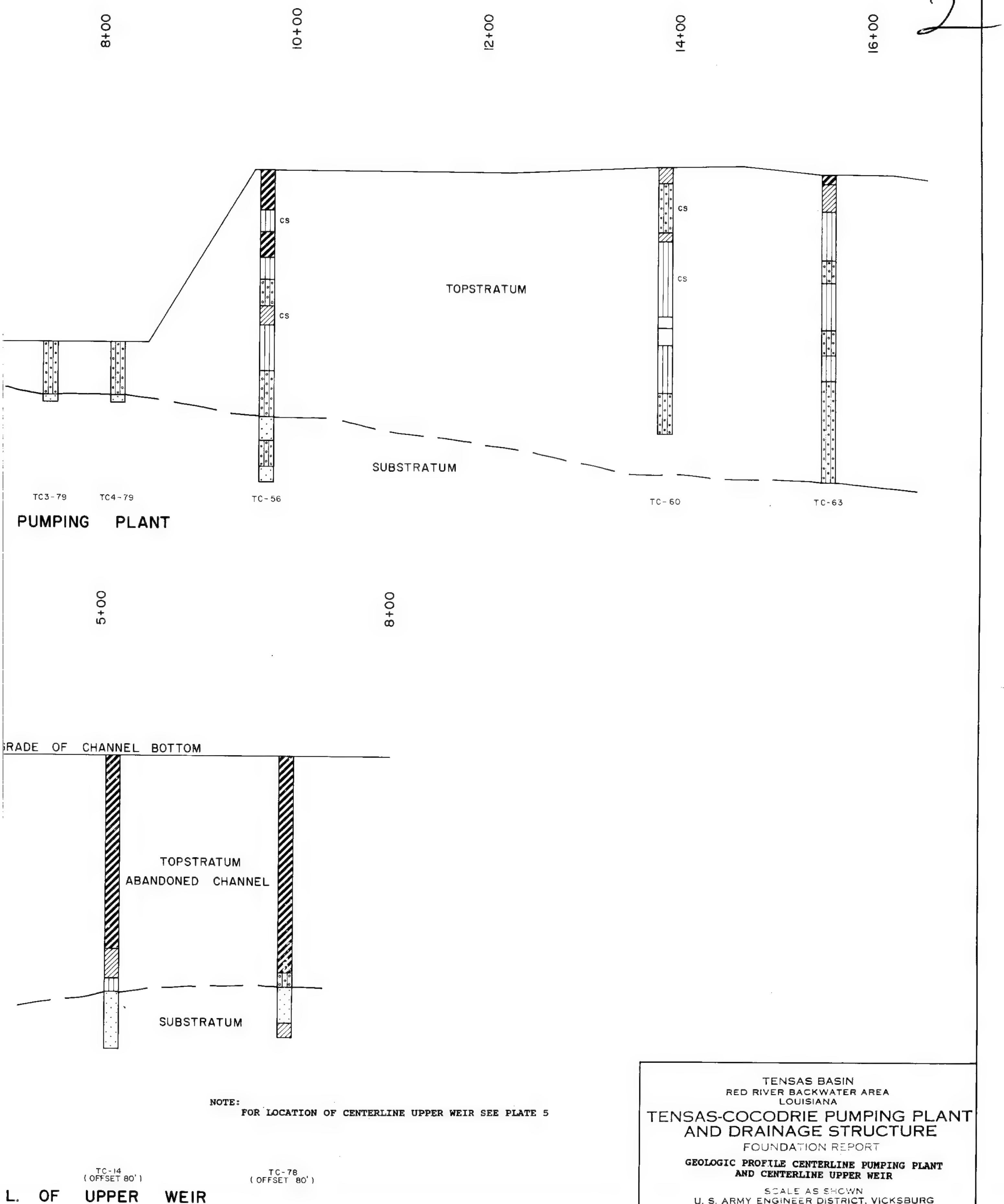
GEOLOGIC PROFILE CENTERLINE PUMPING PLANT CHANNEL

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: **AUGUST 1996** FILE NO: T-14-37



0+00
2+00
4+00
6+00
8+00
50
40
30
20
10
0
-10
-20
TOPSTRATUM
SUBSTRATUM
CS
CS
CS
TC-72
TC-70
TC3-79
TC4-79
C.L. OF PUMPING PLANT
0+00
2+50
5+00
40
30
20
10
0
-10
-20
-30
-40
-50
-60
GRADE OF CHANNEL BO
T
ABAND
S
TC-77
TC-14
(OFFSET 80')
C.L. OF UPPER



NOTE:
FOR LOCATION OF CENTERLINE UPPER WEIR SEE PLATE 5

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

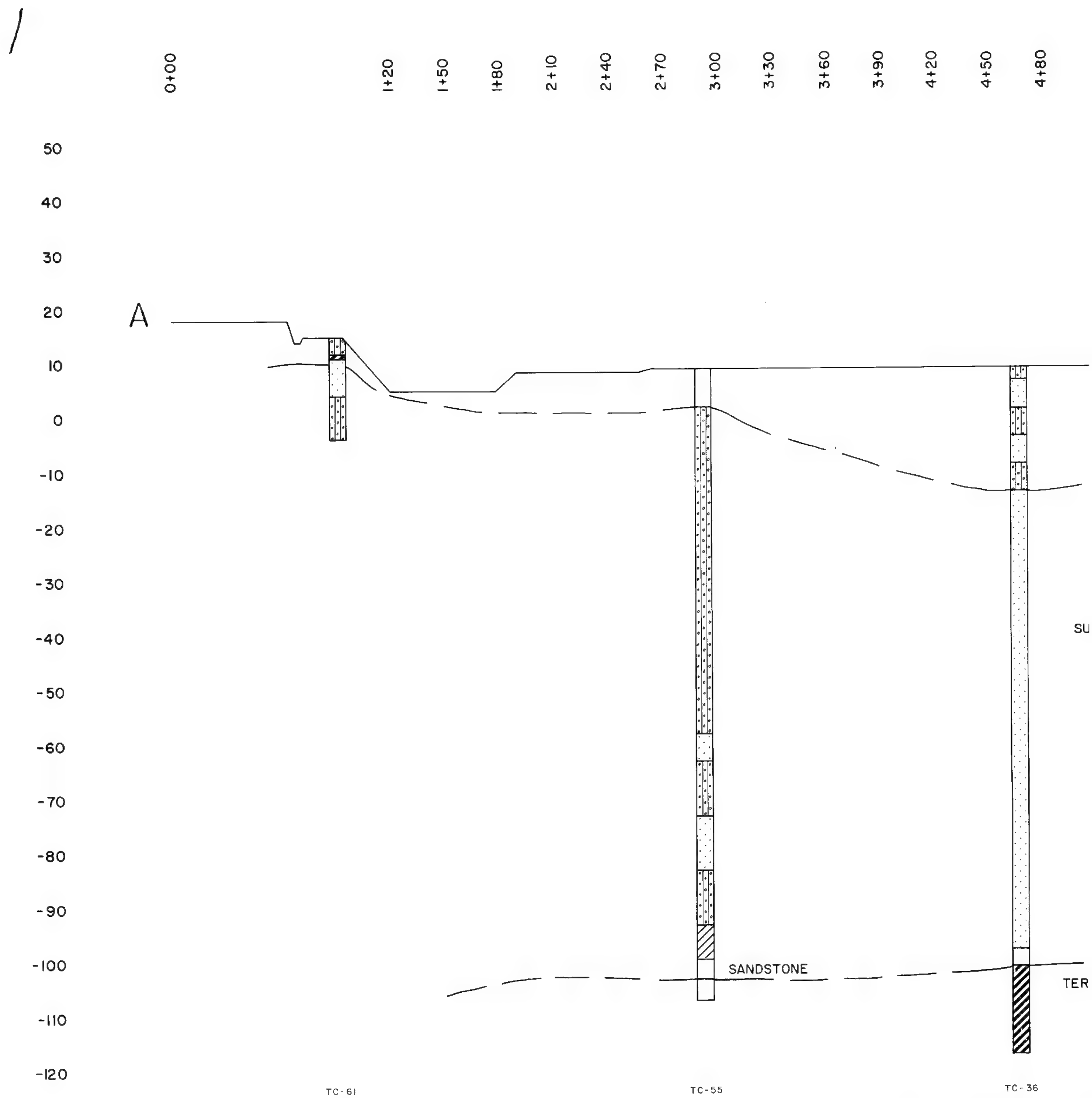
FOUNDATION REPORT

GEOLOGIC PROFILE CENTERLINE PUMPING PLANT AND CENTERLINE UPPER WEIR

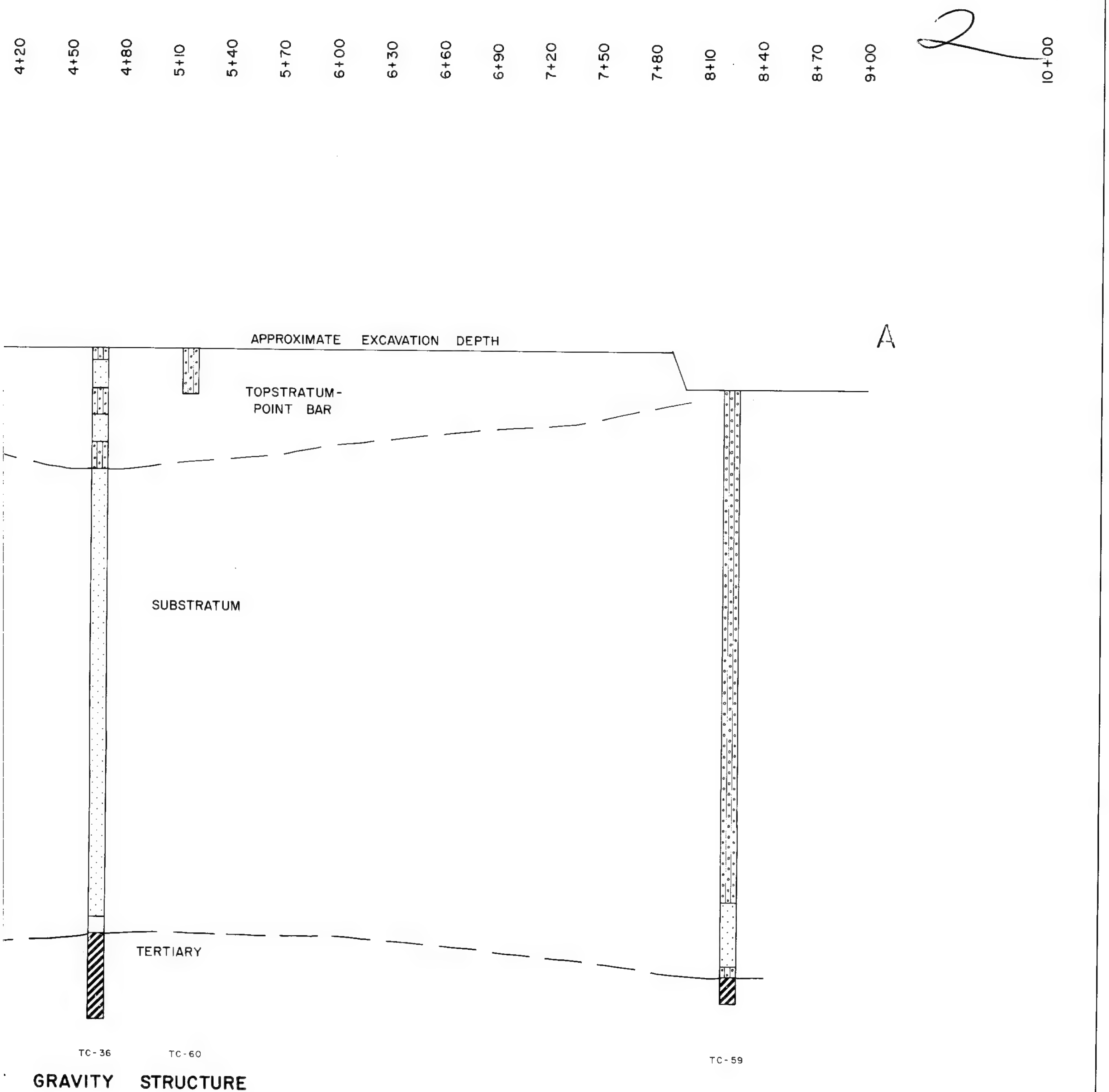
SCALE AS SHOWN

U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



C.L. OF GRAVITY ST



NOTE:
FOR LOCATION OF SECTION A-A SEE PLATES 4 AND 27

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

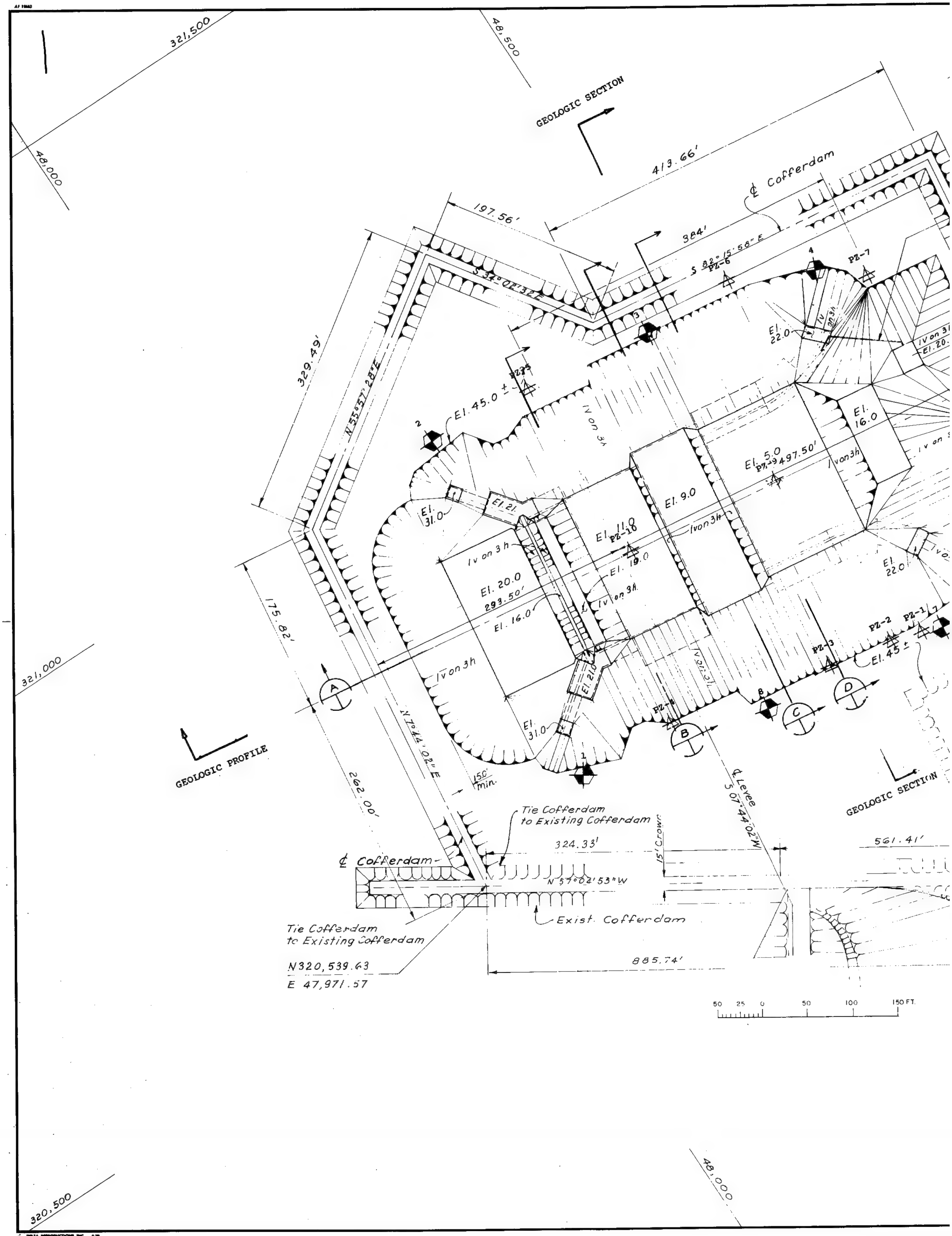
TENSAS-COCODRIE PUMPING PLANT
AND DRAINAGE STRUCTURE

FOUNDATION REPORT

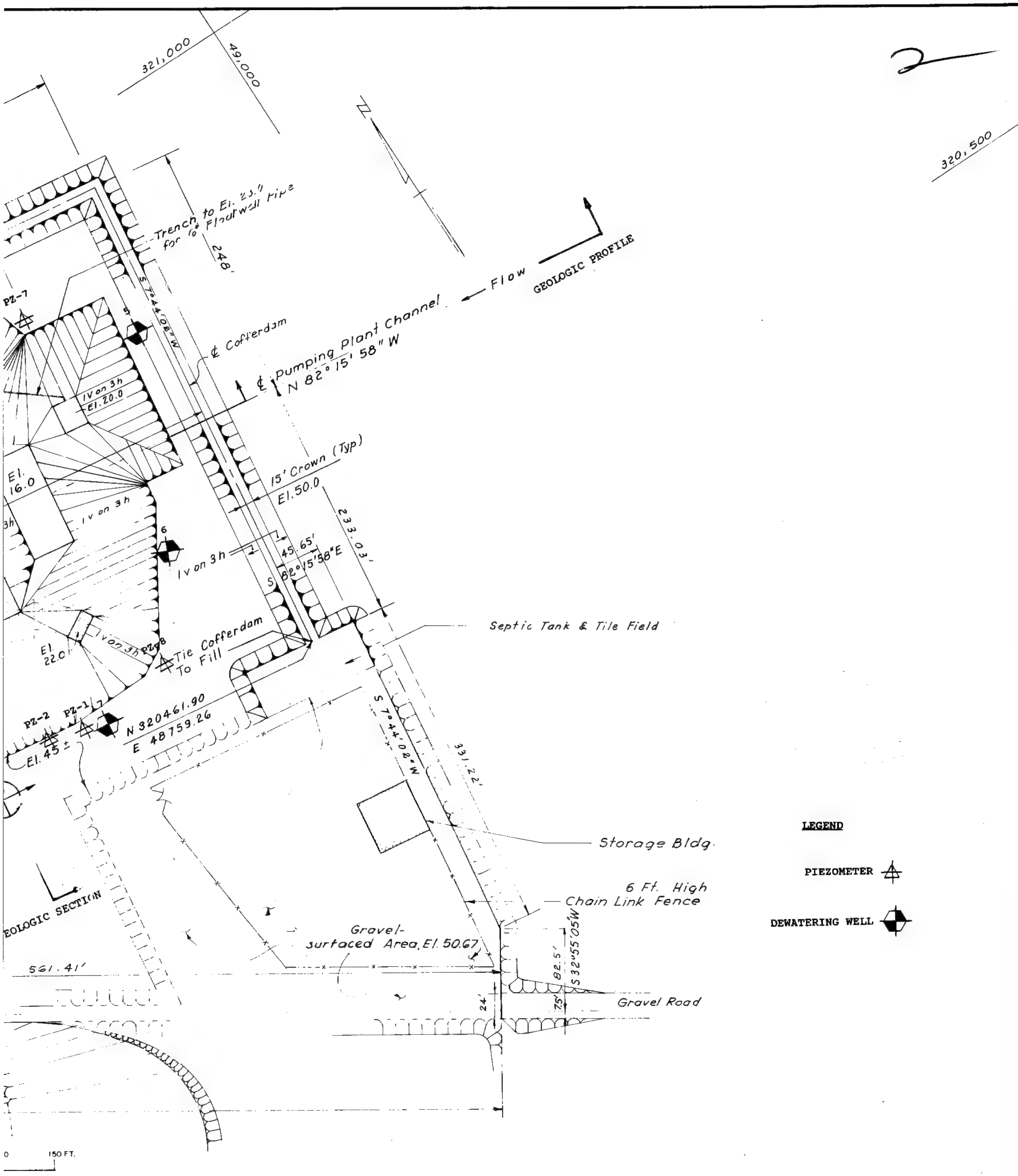
GEOLOGIC PROFILE CENTERLINE
GRAVITY DRAINAGE STRUCTURE

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



321,500
48,500
48,000
GEOLOGIC SECTION
413.66'
℄ Cofferdam
197.56'
384'
S 34°02'32"E
S 82°15'58"E
PZ-6
PZ-7
329.49'
N 55°57'28"E
E1. 45.0 ±
PZ-5
1V on 3h
E1. 22.0
E1. 16.0
E1. 5.0
PZ-9
497.50'
E1. 9.0
E1. 11.0
PZ-10
E1. 19.0
E1. 21.
E1. 31.0
1v on 3h
E1. 20.0
293.50'
E1. 16.0
E1. 21.0
175.82'
321,000
GEOLOGIC PROFILE
N 7°44'02"E
262.00'
15' min.
PZ-1
PZ-2
PZ-3
PZ-8
E1. 45 ±
E1. 22.0
GEOLOGIC SECTION
℄ Levee
S 07°44'02"W
Tie Cofferdam to Existing Cofferdam
324.33'
15' Crown
561.41'
℄ Cofferdam
N 57°02'53"W
Exist. Cofferdam
Tie Cofferdam to Existing Cofferdam
N320,539.63
E 47,971.57
885.74'
50 25 0 50 100 150 FT.
48,000
320,500



NOTE: FOR SECTIONS SEE PLATE 26

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

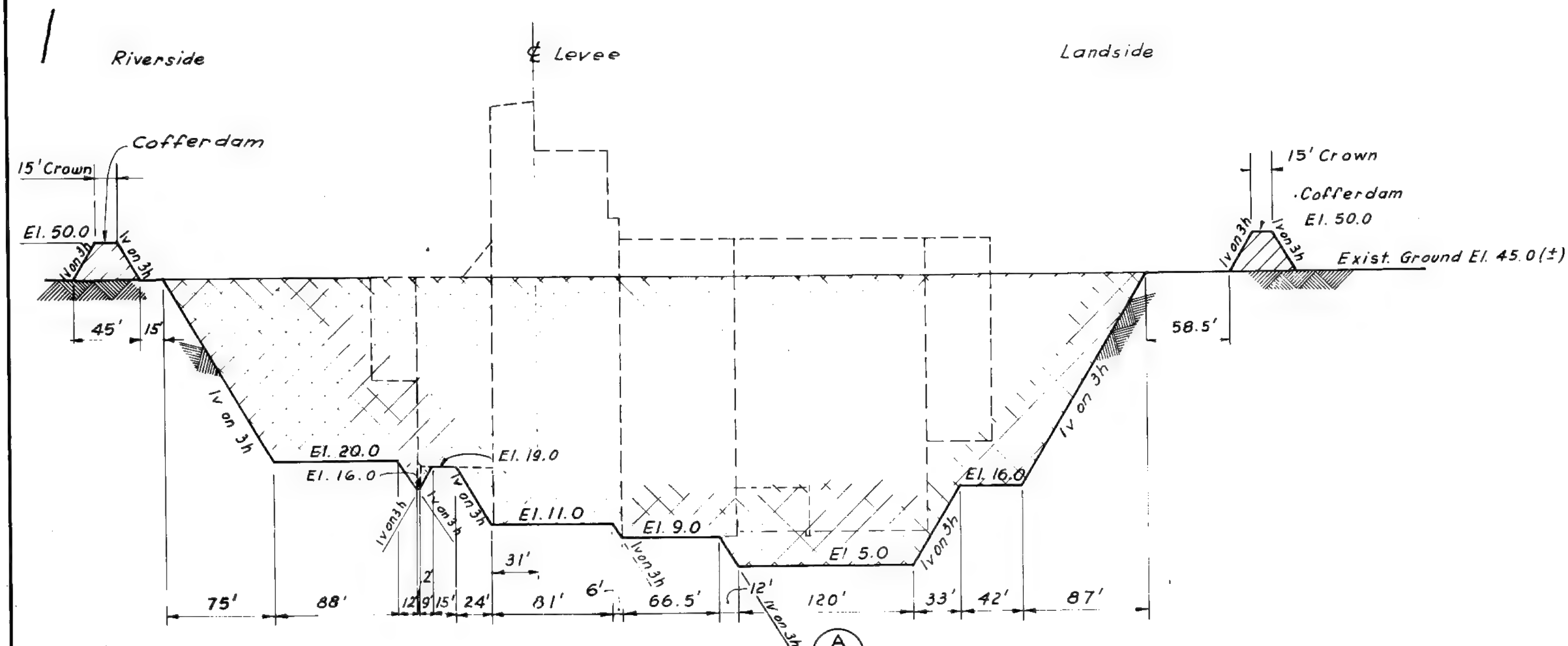
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

PUMPING PLANT STRUCTURE EXCAVATION PLAN WITH CONSTRUCTION DEWATERING

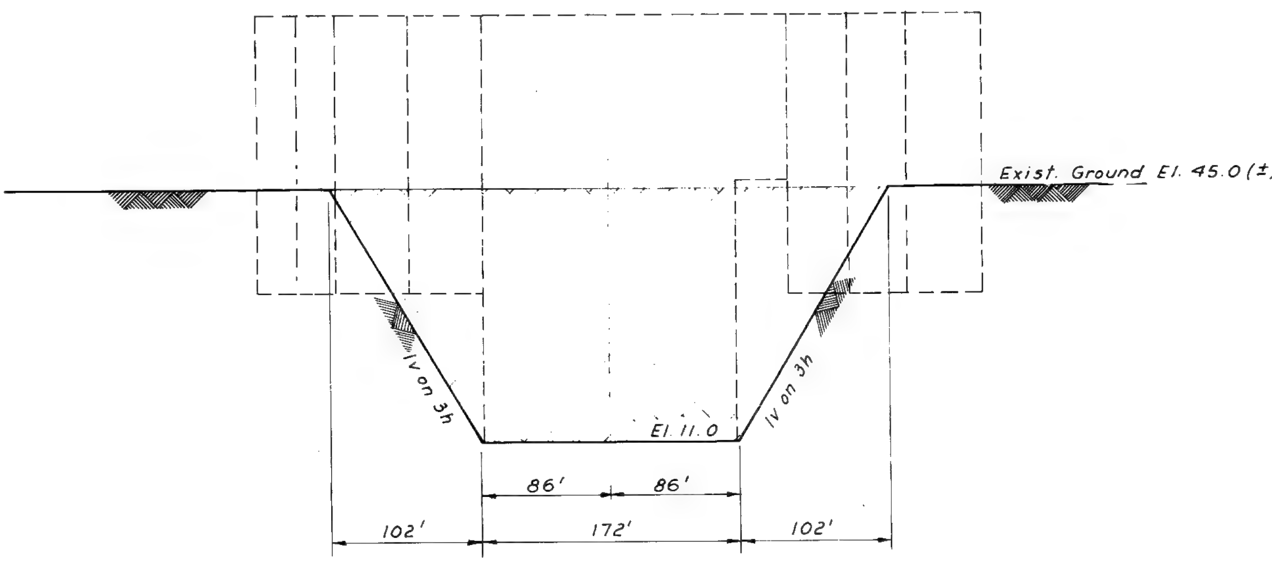
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

/



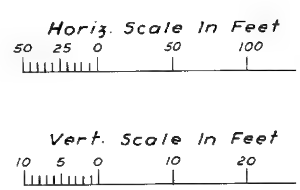
SECTION (A)

Scale: 1" = 50' Horiz.
1" = 10' Vert.



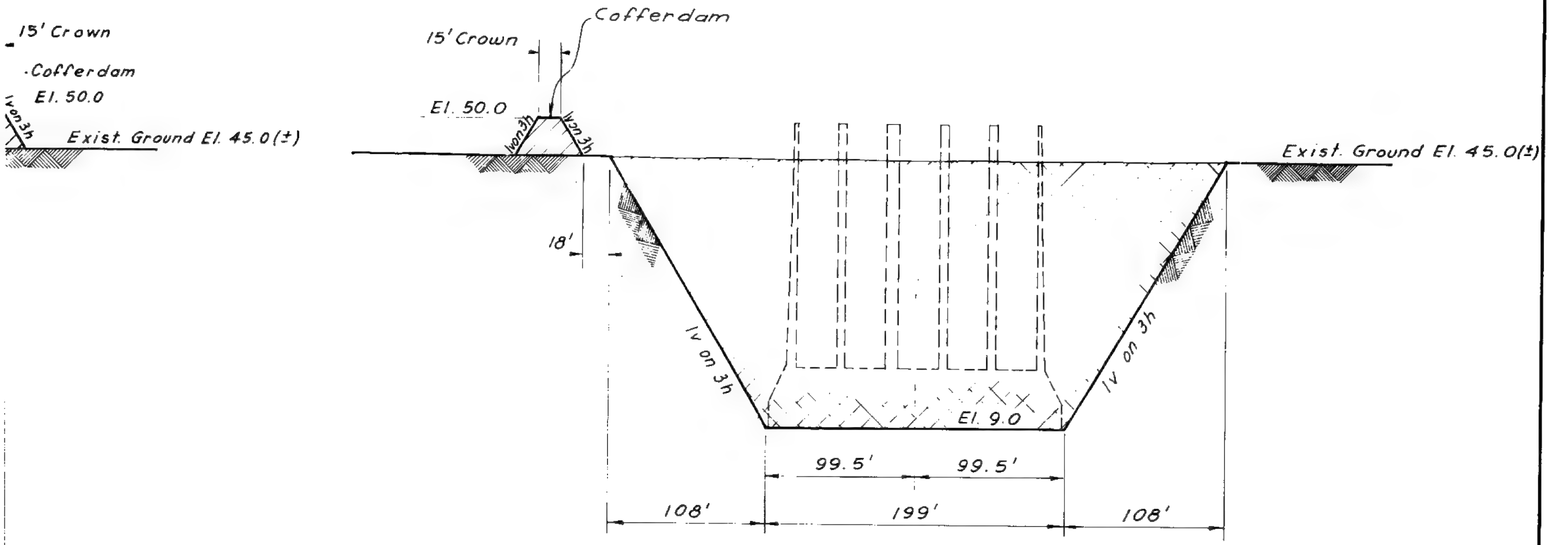
SECTION (B)

Scale: 1" = 50' Horiz.
1" = 10' Vert.

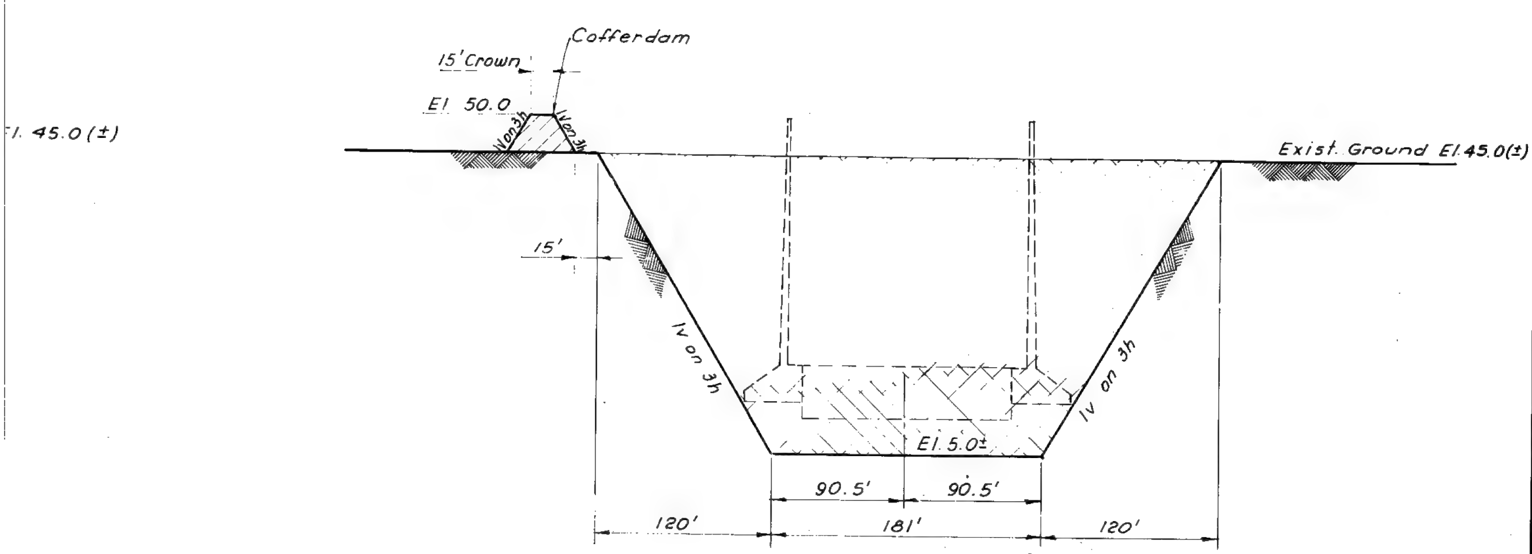


CITY BLUEPRINT 1375

2



SECTION C
Scale: 1" = 50' Horiz.
1" = 10' Vert.



SECTION D
Scale: 1" = 50' Horiz.
1" = 10' Vert.

NOTE:
FOR LOCATION OF SECTIONS SEE PLATE 25

Horiz. Scale In Feet
0 25 0 50 100 150 Ft.

Vert. Scale In Feet
5 0 10 20 30 Ft.

Legend:

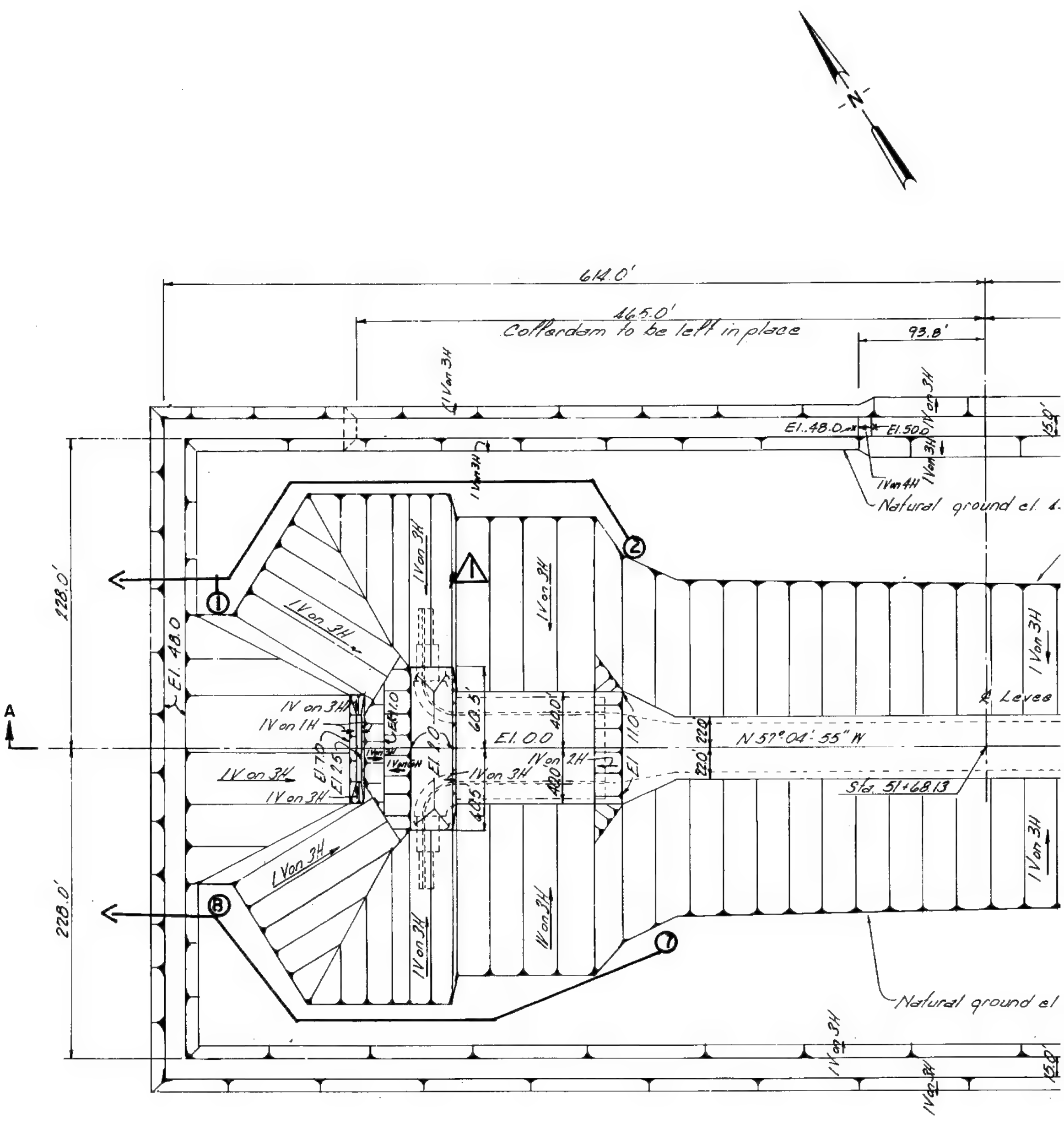
Required Excavation

Required Fill

Limits of Structures

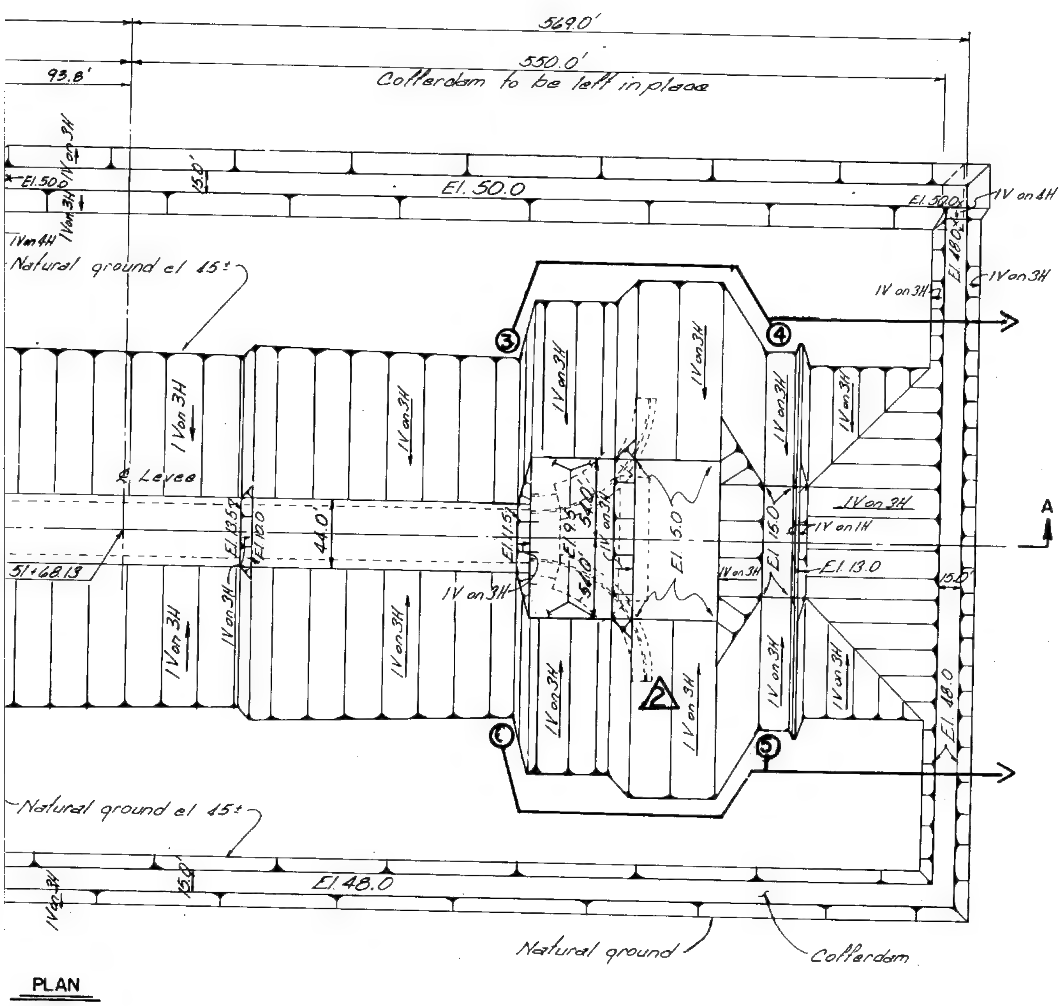
Note:
Minor Excavation
Details not Shown.

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE
FOUNDATION REPORT
STRUCTURE EXCAVATION SECTIONS PUMPING PLANT
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



614.0'
465.0'
Cofferdam to be left in place
93.8'
El. 48.0
El. 50.0
Natural ground el.
El. 48.0
228.0'
228.0'
A
1V on 3H
El. 0.0
N 57° 04' 55" W
Sta. 51+68.13
Levee
60.5'
40.0'
40.5'
22.0
El. 11.0
El. 7.0
El. 2.5

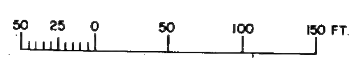
PLAN



LEGEND

○ DEWATERING WELL

△ CONSTRUCTION PIEZOMETERS



Reference:
For section A-A SEE PLATE 24

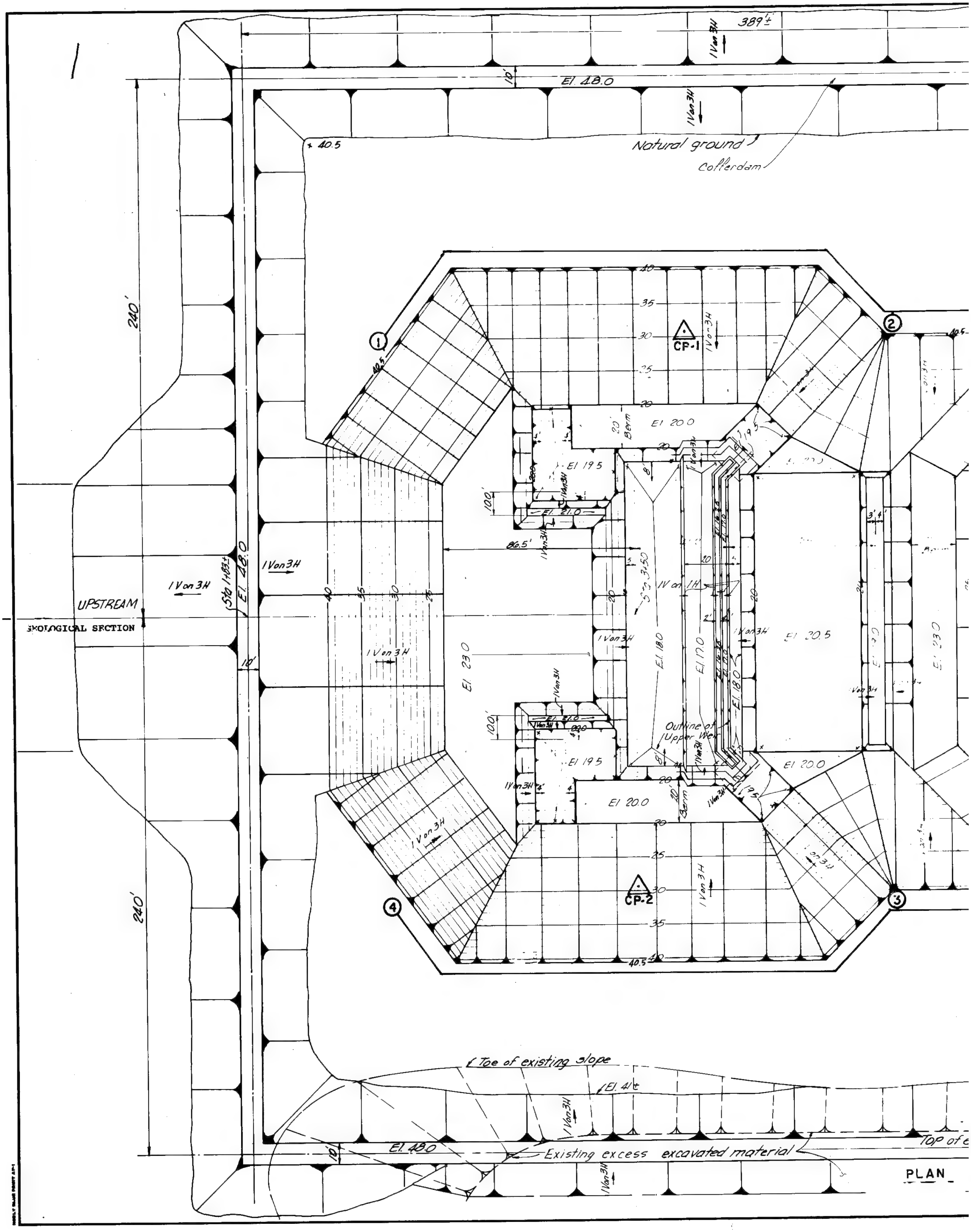
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

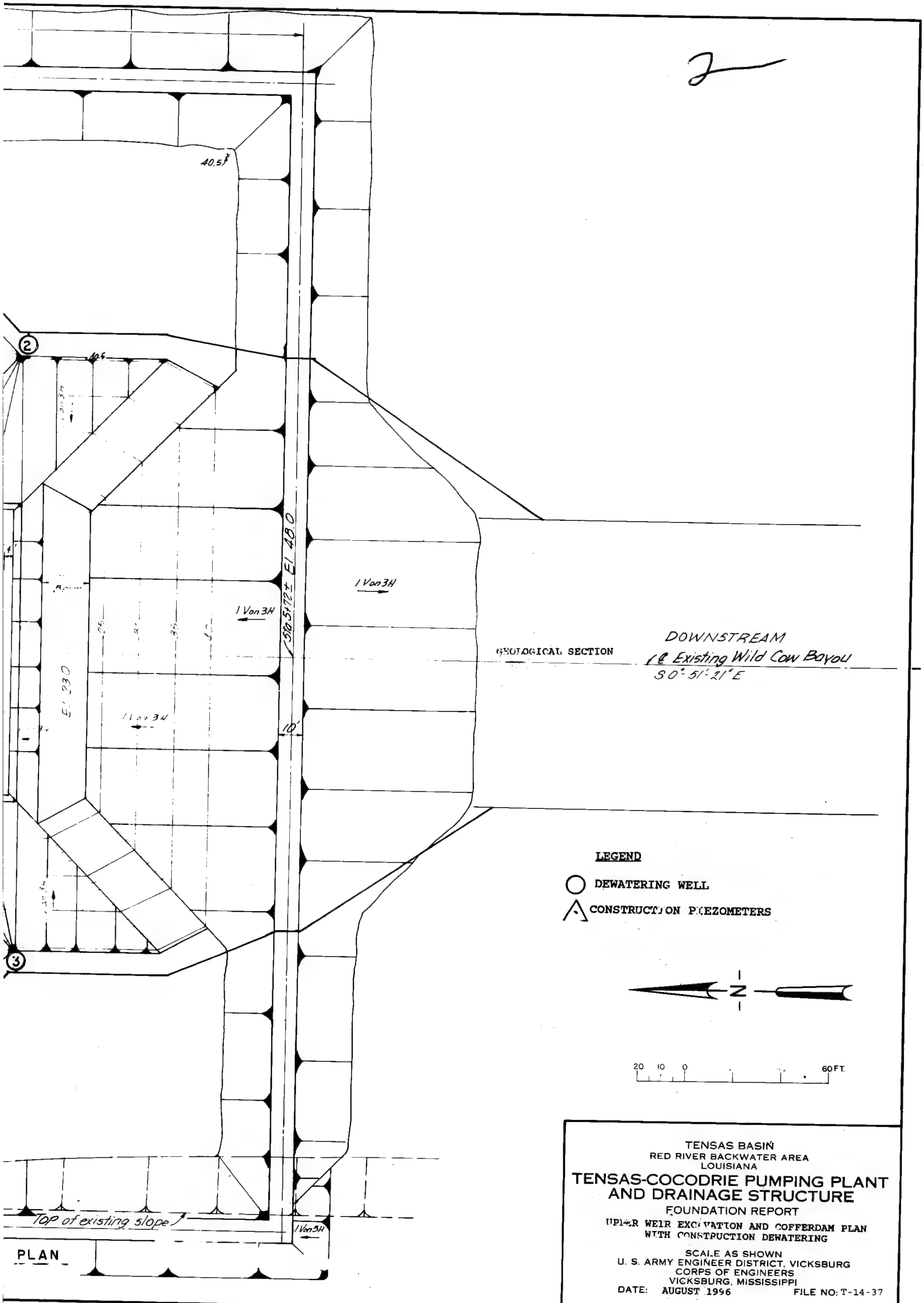
FOUNDATION REPORT

GRAVITY DRAINAGE STRUCTURE EXCAVATION PLAN WITH CONSTRUCTION DEWATERING

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



389'±
El. 48.0
1V on 3H
Natural ground
Cofferdam
240'
CP-1
CP-2
Berm
El. 20.0
El. 19.5
El. 21.0
El. 23.0
El. 18.0
El. 17.0
El. 20.5
86.5'
1V on 1H
Outline of Upper Weir
UPSTREAM
GEOLOGICAL SECTION
Sta 1+83±
Toe of existing slope
El. 41±
Existing excess excavated material
TOP of e
PLAN



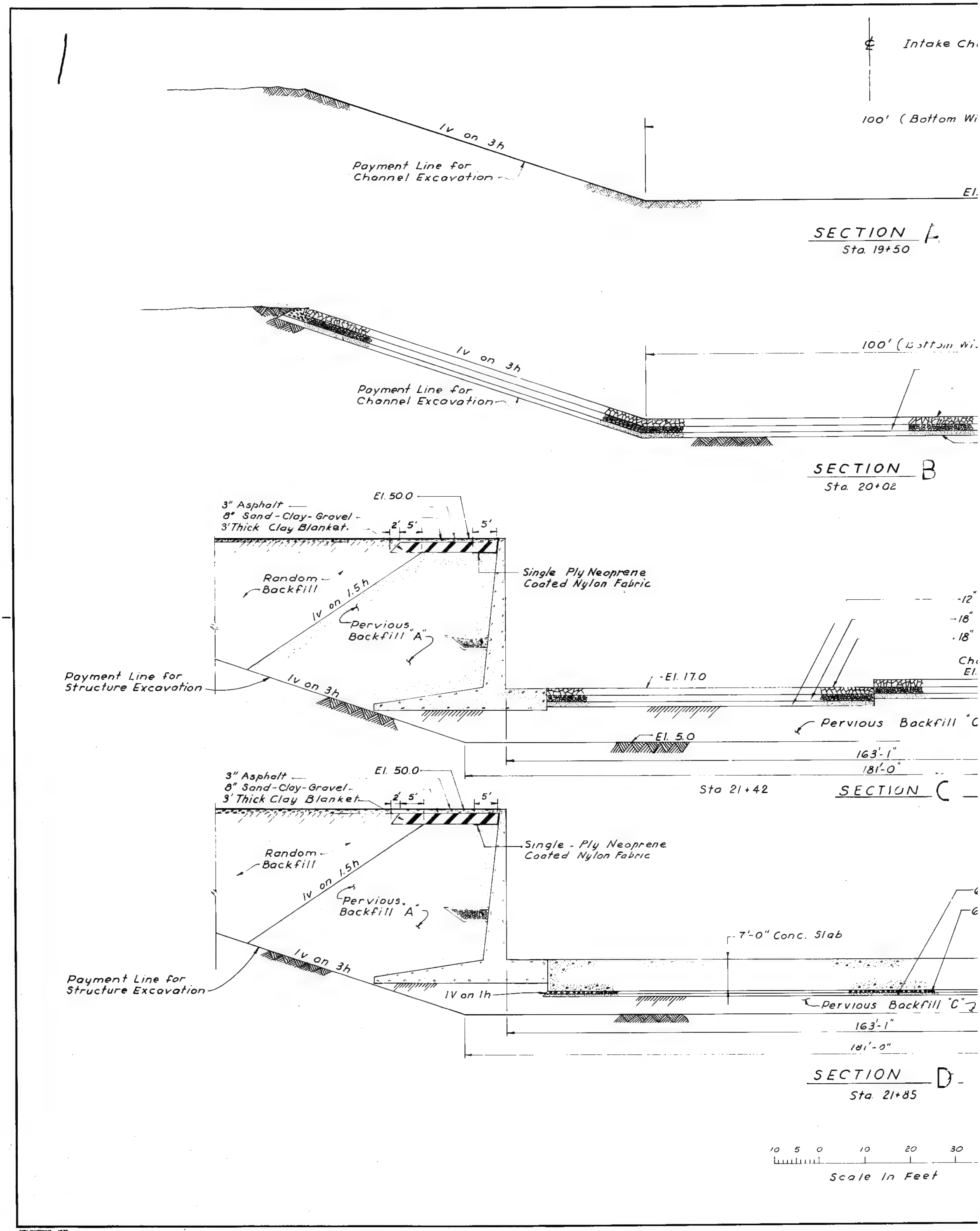
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT
AND DRAINAGE STRUCTURE

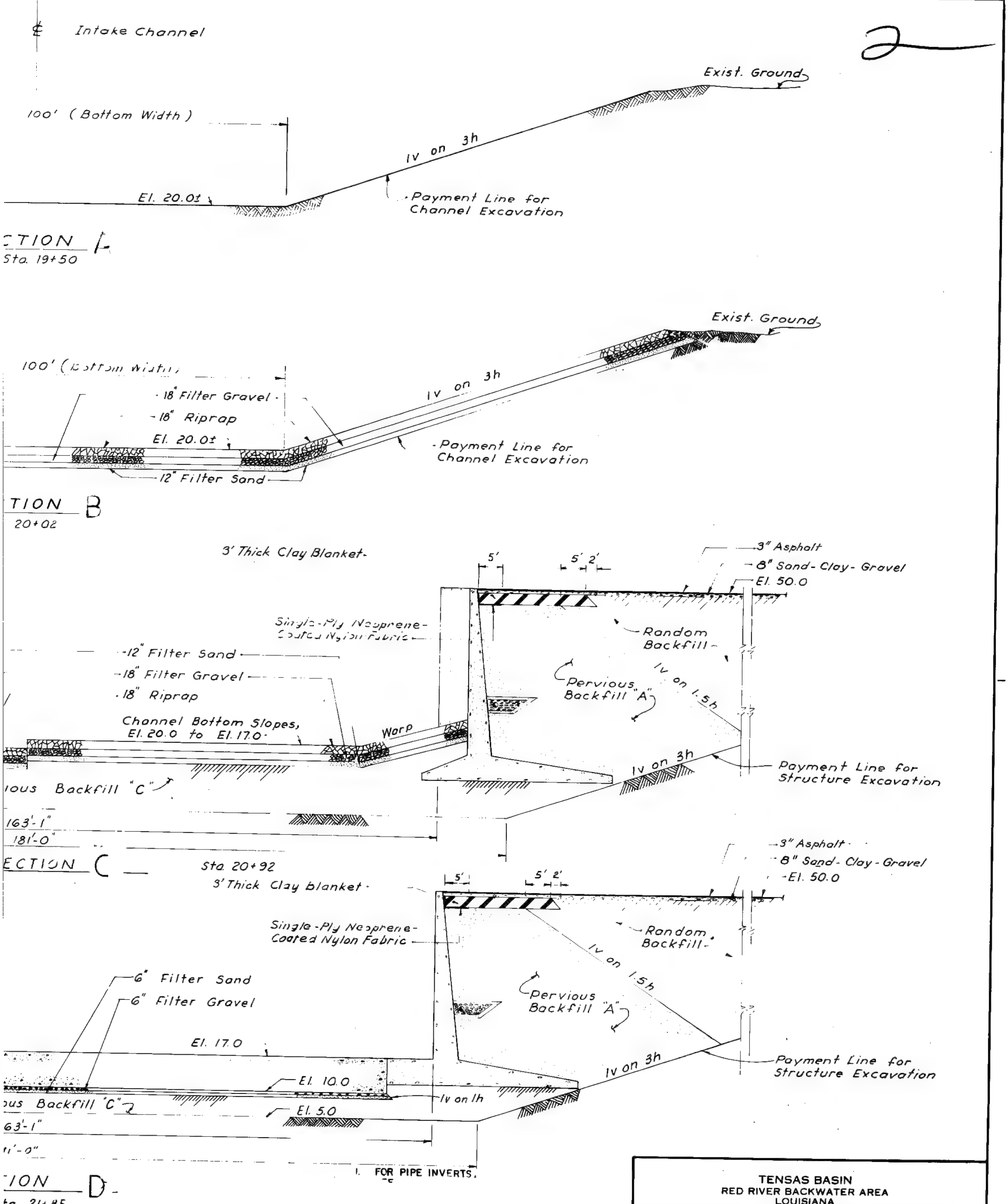
FOUNDATION REPORT

UPPER WEIR EXCAVATION AND COFFERDAM PLAN
WITH CONSTRUCTION DEWATERING

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



Intake Ch
100' (Bottom Wi
1v on 3h
Payment Line for Channel Excavation
El.
SECTION A
Sta. 19+50
1v on 3h
Payment Line for Channel Excavation
SECTION B
Sta. 20+02
3" Asphalt
8" Sand-Clay-Gravel
3' Thick Clay Blanket.
El. 50.0
2'
5'
5'
Single Ply Neoprene Coated Nylon Fabric
Random Backfill
1v on 1.5h
Pervious Backfill "A"
Payment Line for Structure Excavation
1v on 3h
-El. 17.0
-12"
-18"
-18"
Pervious Backfill "C
El. 5.0
163'-1"
181'-0"
Sta 21+42
SECTION C
3" Asphalt
8" Sand-Clay-Gravel
3' Thick Clay Blanket
El. 50.0
2'
5'
5'
Single-Ply Neoprene Coated Nylon Fabric
Random Backfill
1v on 1.5h
Pervious Backfill A
7'-0" Conc. Slab
Payment Line for Structure Excavation
1v on 3h
1V on 1h
Pervious Backfill "C"
163'-1"
181'-0"
SECTION D
Sta. 21+85
10 5 0 10 20 30
Scale In Feet



FOR LOCATION OF SECTIONS SEE PLATE 3

0 20 30 40 Ft.
e In Feet

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

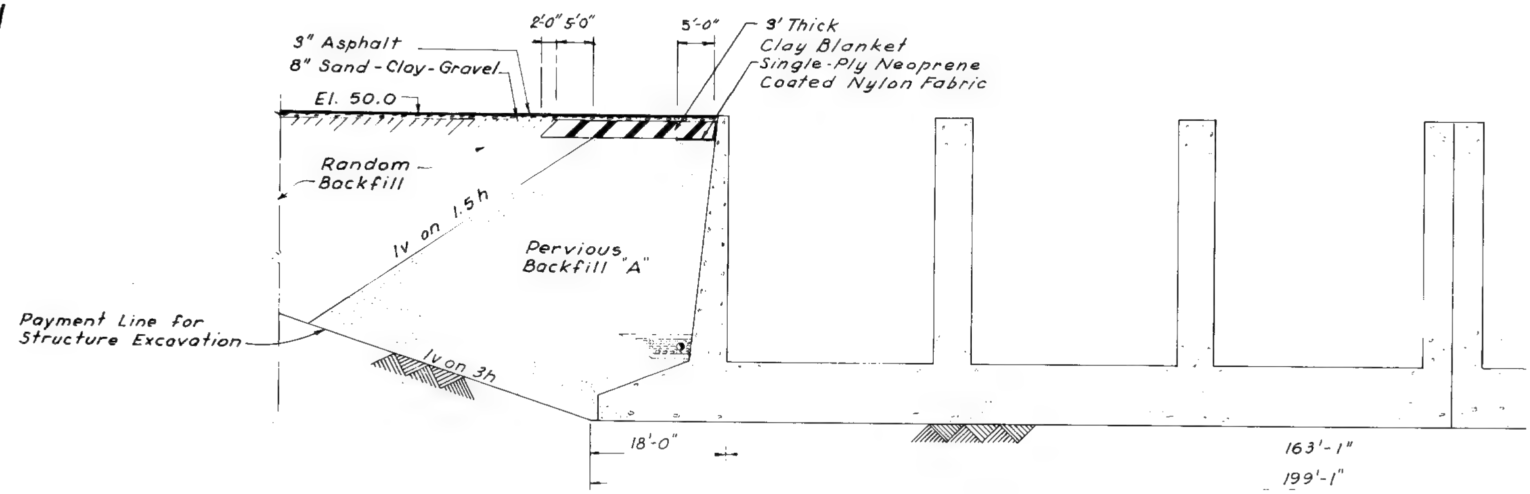
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

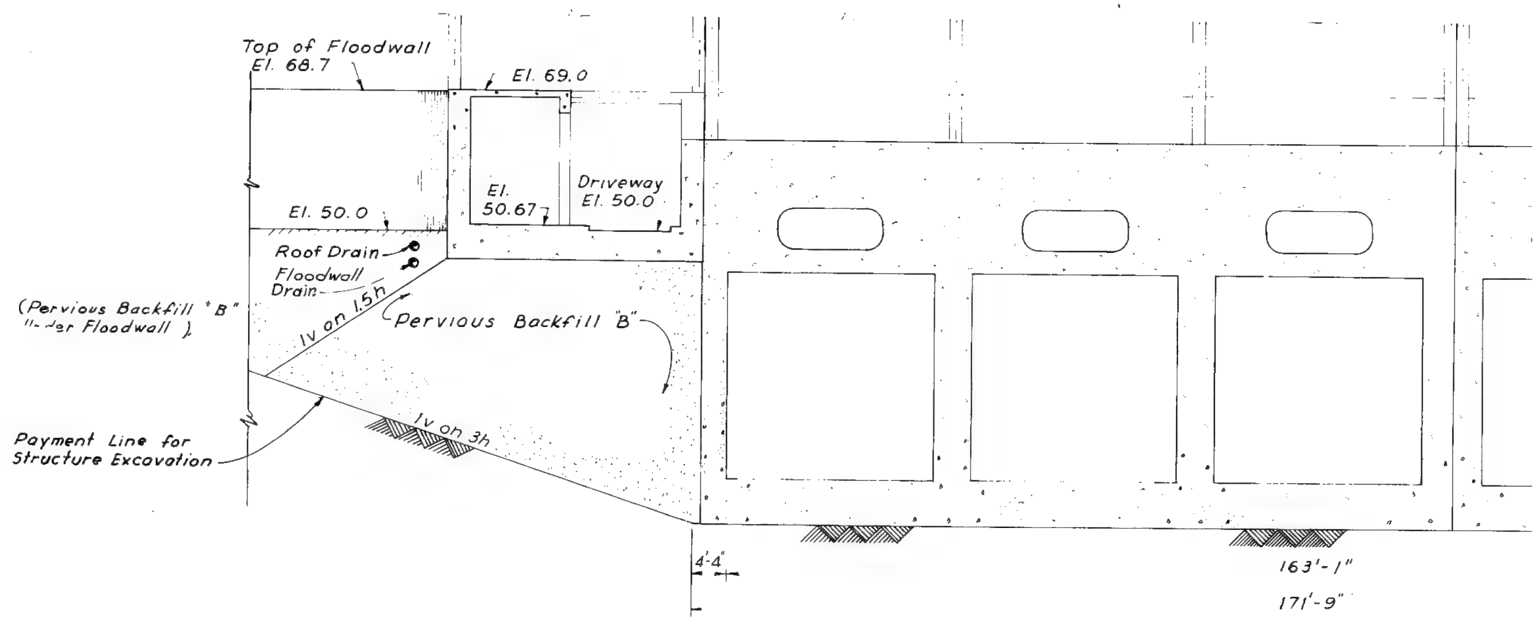
EARTHWORK SECTIONS PUMPING PLANT

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

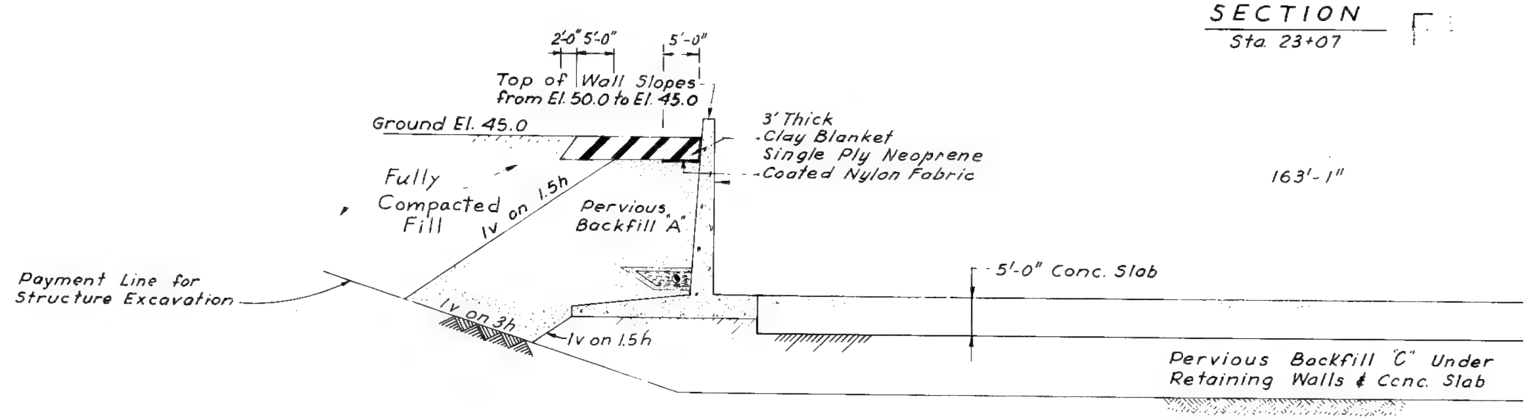
DATE: AUGUST 1996 FILE NO: T-14-37



SECTION
Sta. 22+17



SECTION
Sta. 23+07



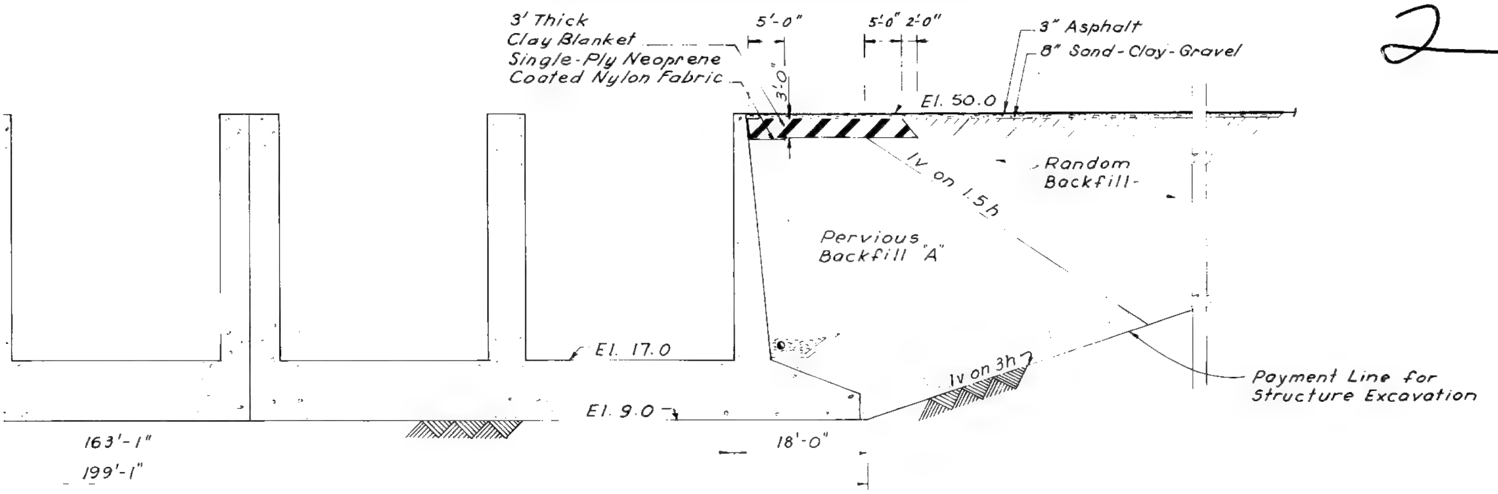
SECTION G
Sta. 23+72

10 5 0 10 20 30 40 Ft.

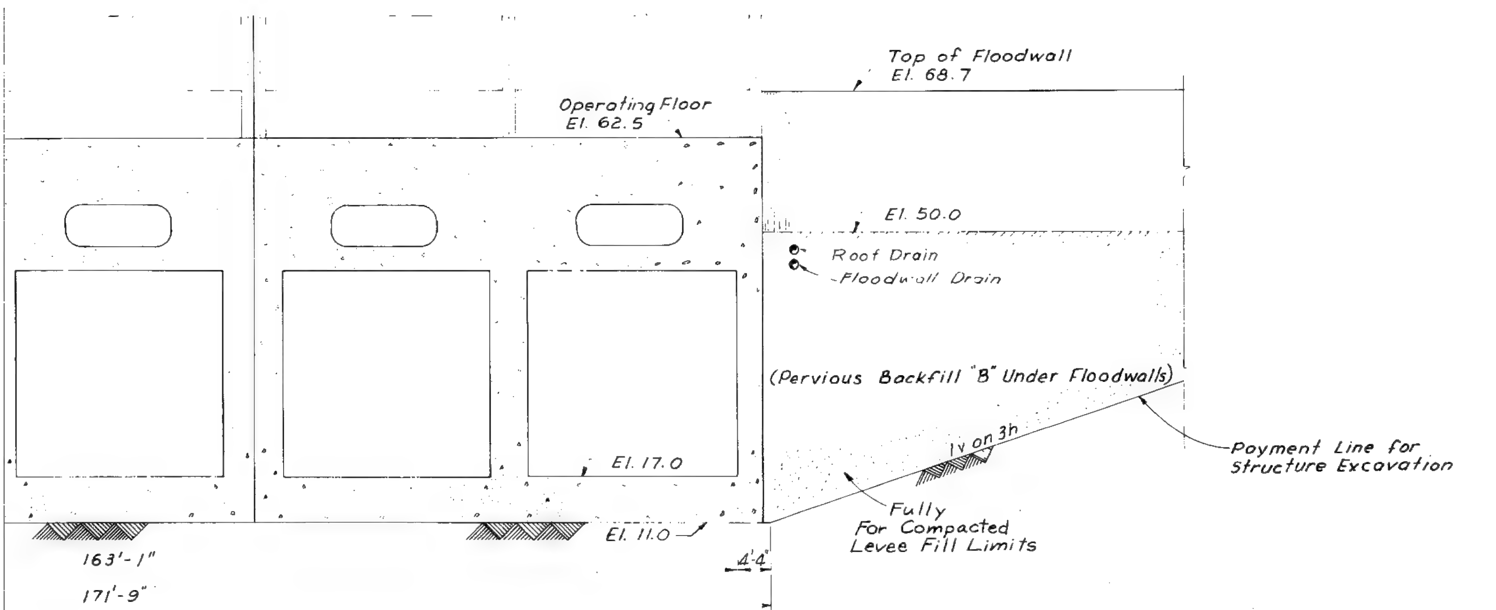
Scale: 1" = 10'-0"

CITY BLUEPRINT 1375

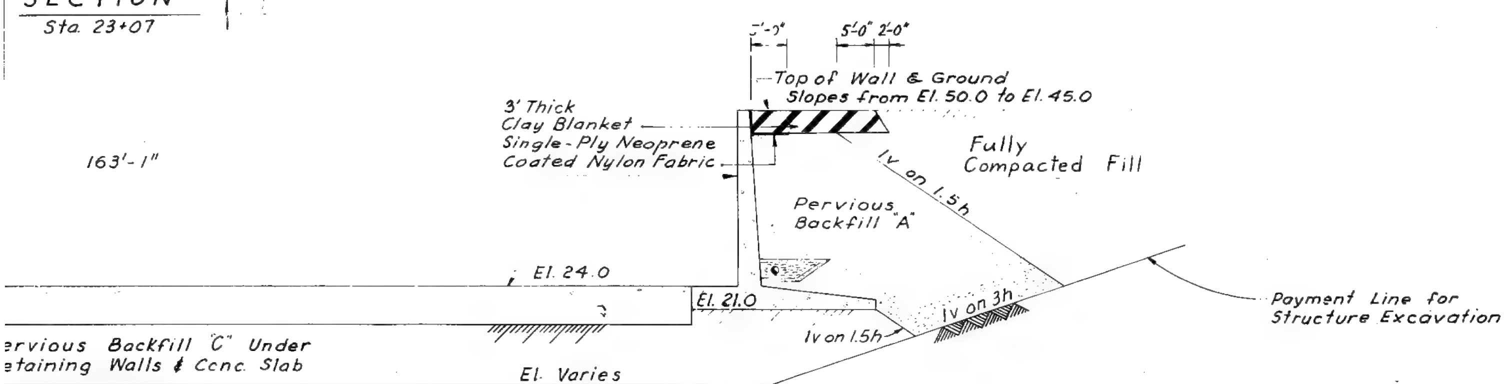
2



SECTION E
Sta. 22+17



SECTION F
Sta. 23+07



SECTION G
Sta. 23+72

0 10 20 30 40 Ft.
Scale: 1" = 10'-0"

FOR LOCATION OF SECTIONS SEE PLATE 3

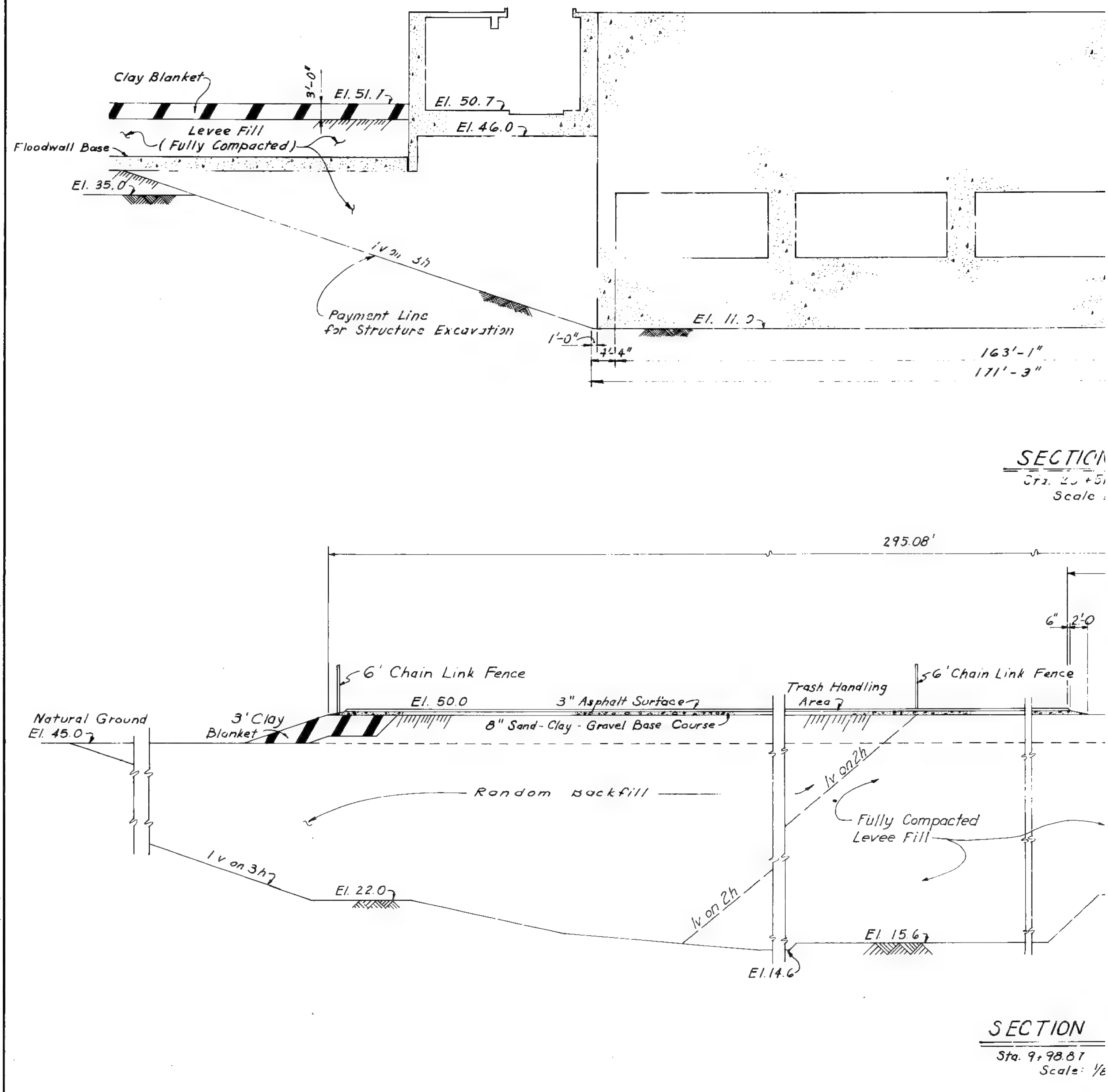
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

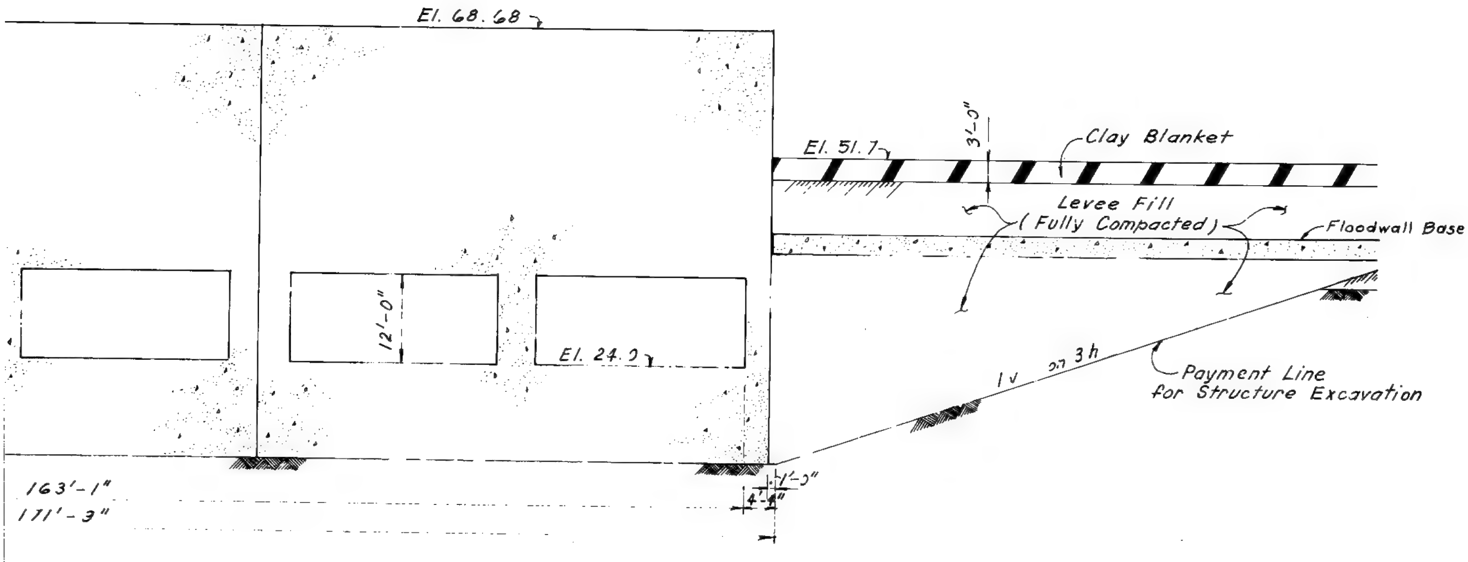
EARTHWORK SECTIONS PUMPING PLANT

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



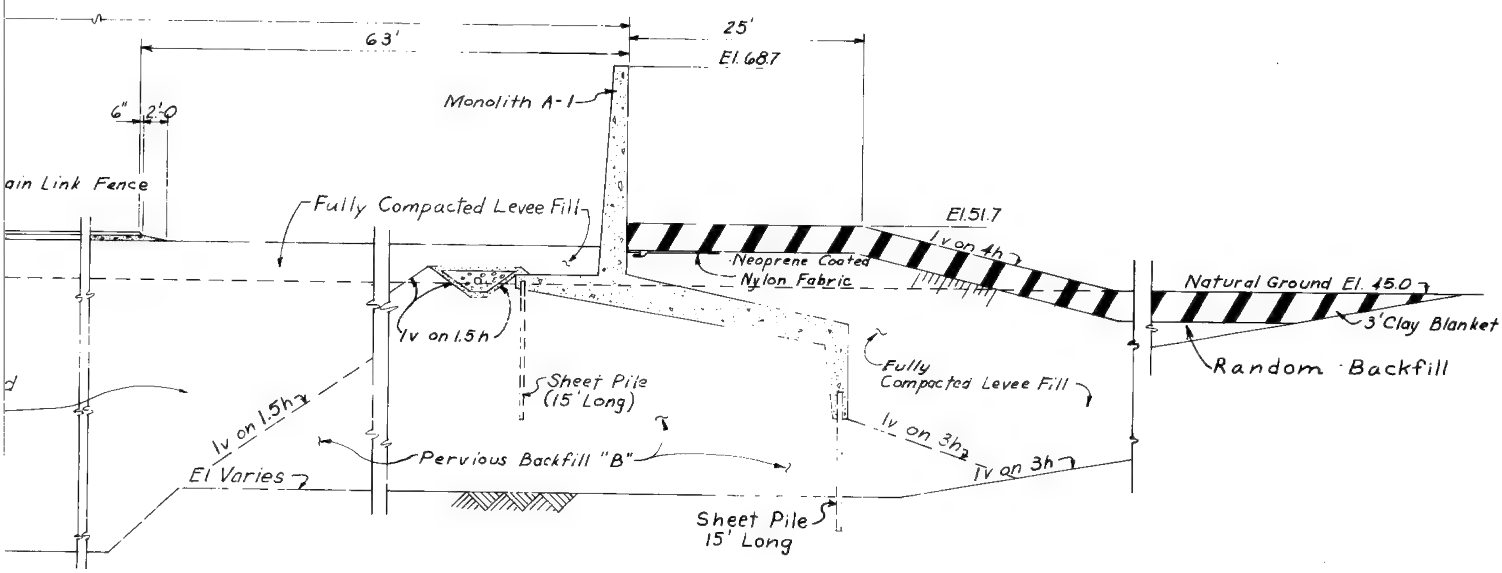
Clay Blanket
3'-0"
El. 51.1
El. 50.7
El. 46.0
Levee Fill
(Fully Compacted)
Floodwall Base
El. 35.0
1v on 3h
Payment Line
for Structure Excavation
1'-0"
7'-4"
El. 11.0
163'-1"
171'-3"
SECTION
Scale
295.08'
6"
2'-0
6' Chain Link Fence
El. 50.0
3" Asphalt Surface
Trash Handling
Area
6' Chain Link Fence
Natural Ground
El. 45.0
3' Clay
Blanket
8" Sand-Clay-Gravel Base Course
Random Backfill
1v on 2h
Fully Compacted
Levee Fill
1 v on 3h
El. 22.0
1v on 2h
El. 15.6
El. 14.6
SECTION
Sta. 9+98.87

2



SECTION H

Sta. [illegible]
Scale: 1"=10'



10' 0 10' 20' 30'
Scale: 1"=10'

SECTION I

Sta. 9+98.87
Scale: 1/8"=1'-0"

NOTE:
FOR LOCATION OF SECTIONS H AND I SEE PLATE 3

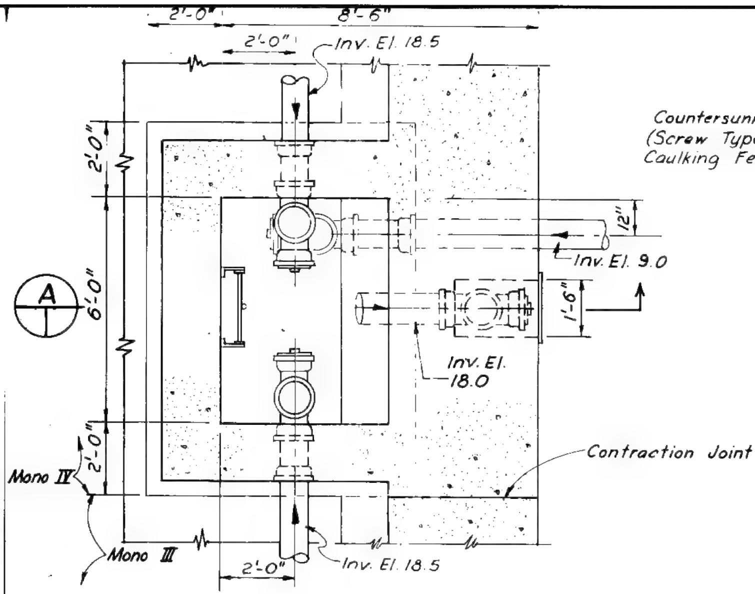
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

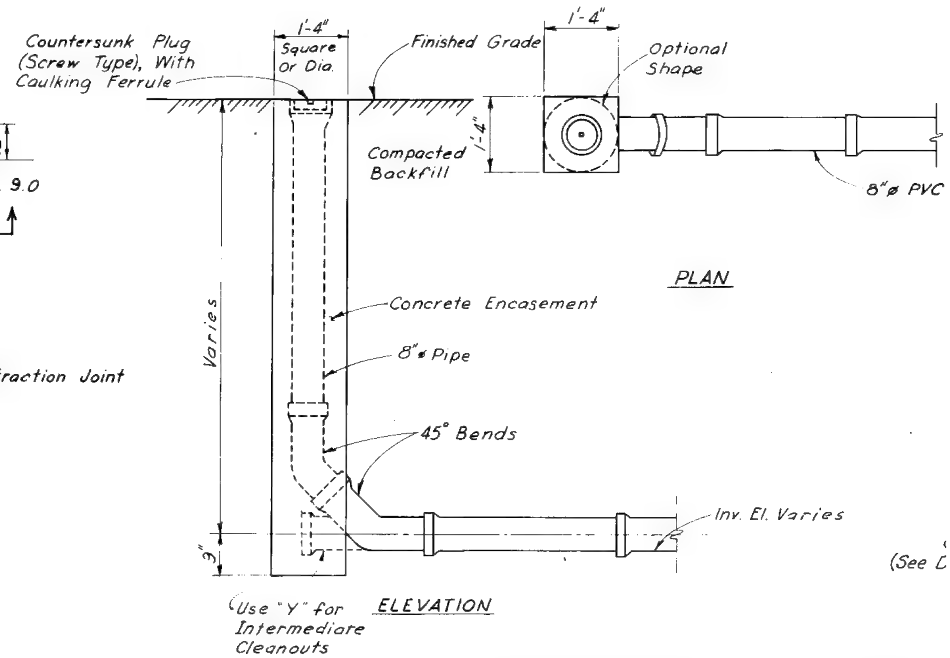
FOUNDATION REPORT

EARTHWORK SECTIONS
PUMPING PLANT

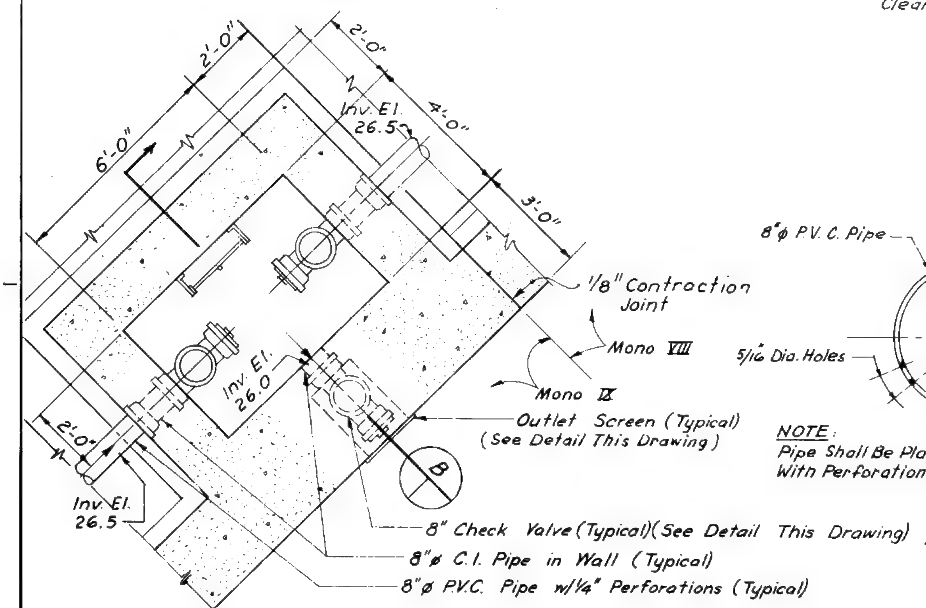
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



PLAN-SECTION-EL.29.0±
MANHOLE "I-N" SHOWN
MANHOLE "I-S" OPPOSITE HAND
Scale: ½"=1'-0"

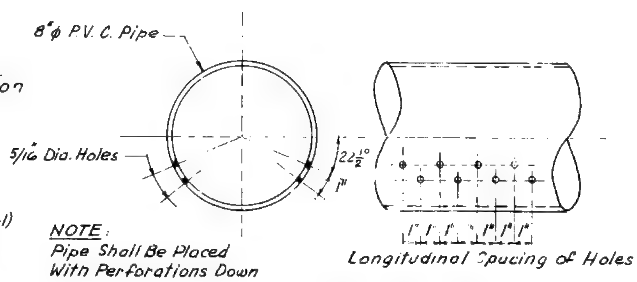


CLEANOUT DETAILS
Scale: ¾"=1'-0"



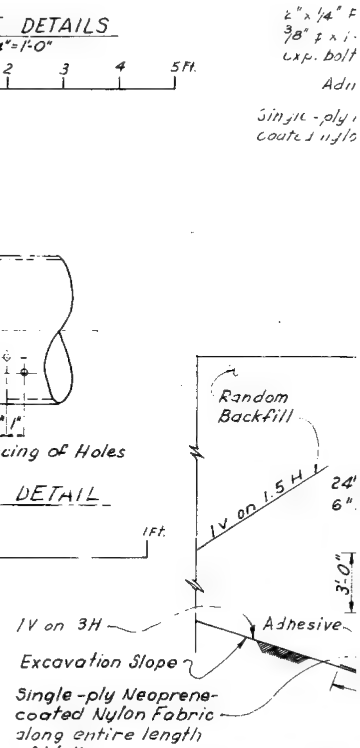
PLAN-SECTION-El 29.0±
MANHOLE "3-N" SHOWN
MANHOLE "3-S" OPPOSITE HAND
Scale: ½"=1'-0"

SCALE: ½"=1'-0"

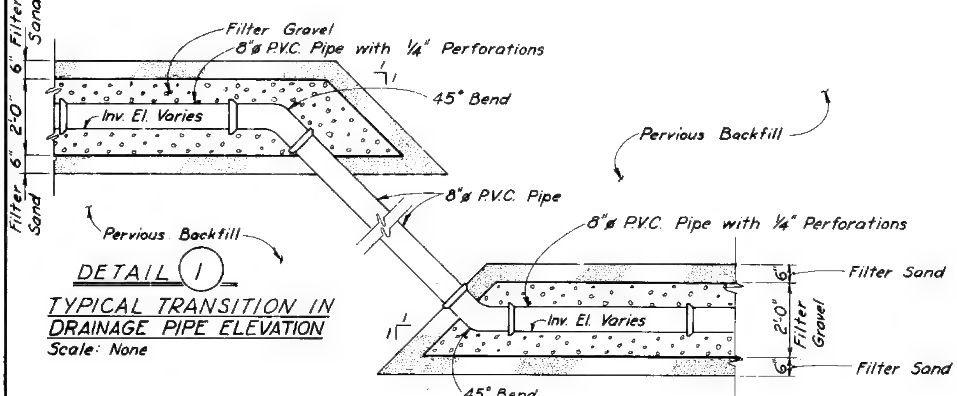


NOTE: Pipe Shall Be Placed With Perforations Down

PIPE PERFORATIONS DETAIL
Scale: 3" = 1'-0"

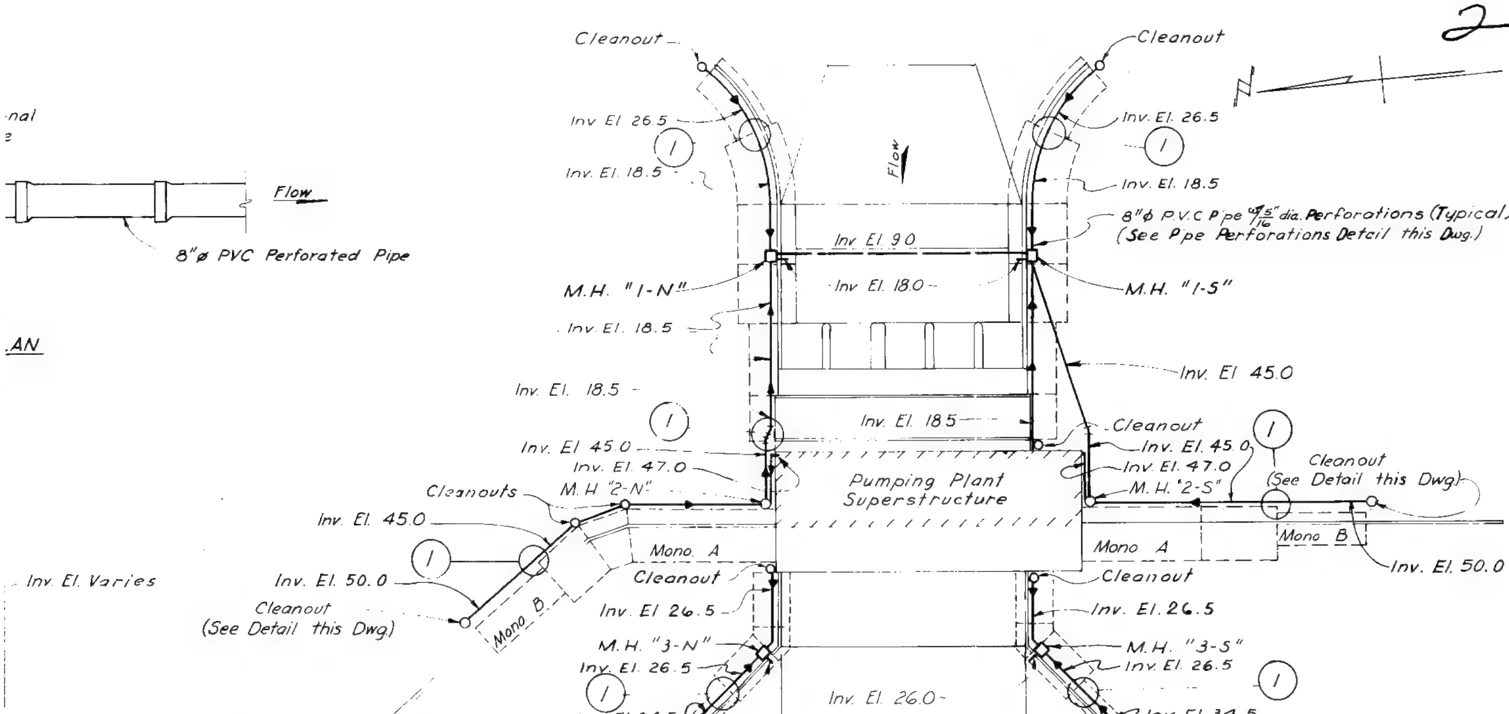


TYPICAL WALL
SCALE: NONE



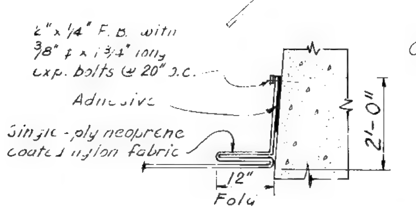
DETAIL 1
TYPICAL TRANSITION IN DRAINAGE PIPE ELEVATION
Scale: None

REFERENCE:
1. FOR SECTIONS A AND B SEE PLATE 33



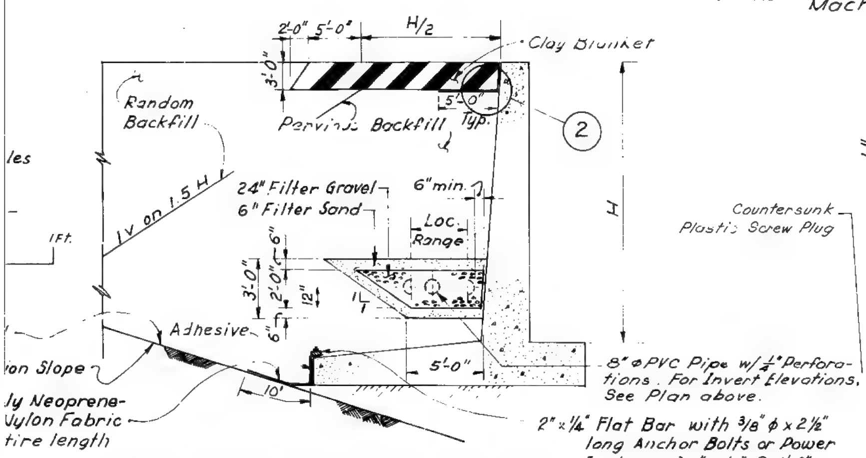
PLAN

SCALE: 1" = 50'



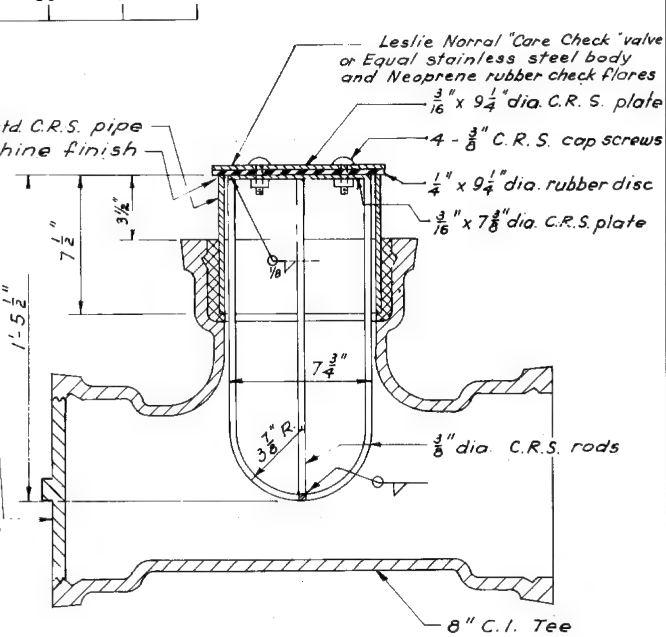
DETAIL (2)

Scale: 3/4" = 1'-0"



TYPICAL WALL BACKFILL DETAIL

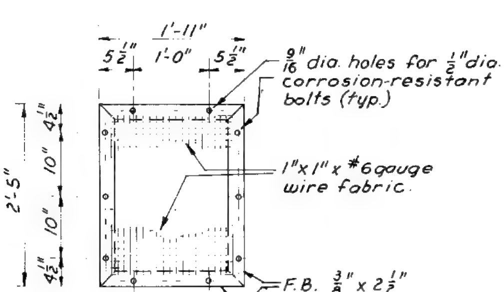
SCALE: NONE



8 IN. CHECK VALVE DETAIL

(15 REQ'D.)

SCALE: 3" = 1'-0"



OUTLET SCREEN DETAIL (4 REQ'D.)

SCALE: 1" = 1'-0"

AND B SEE PLATE 33

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

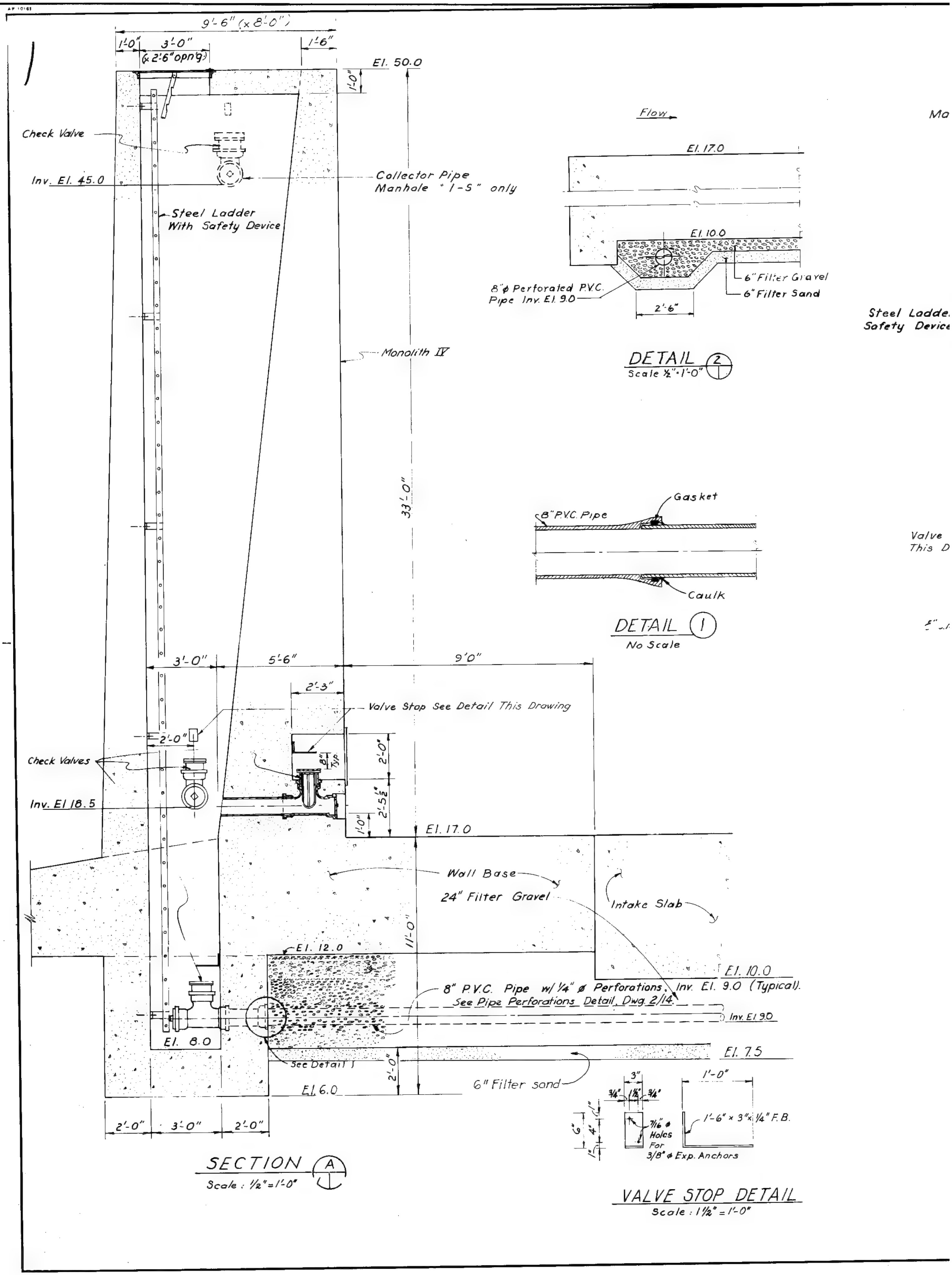
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

PUMPING PLANT
DRAINAGE COLLECTOR SYSTEM SECTIONS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37

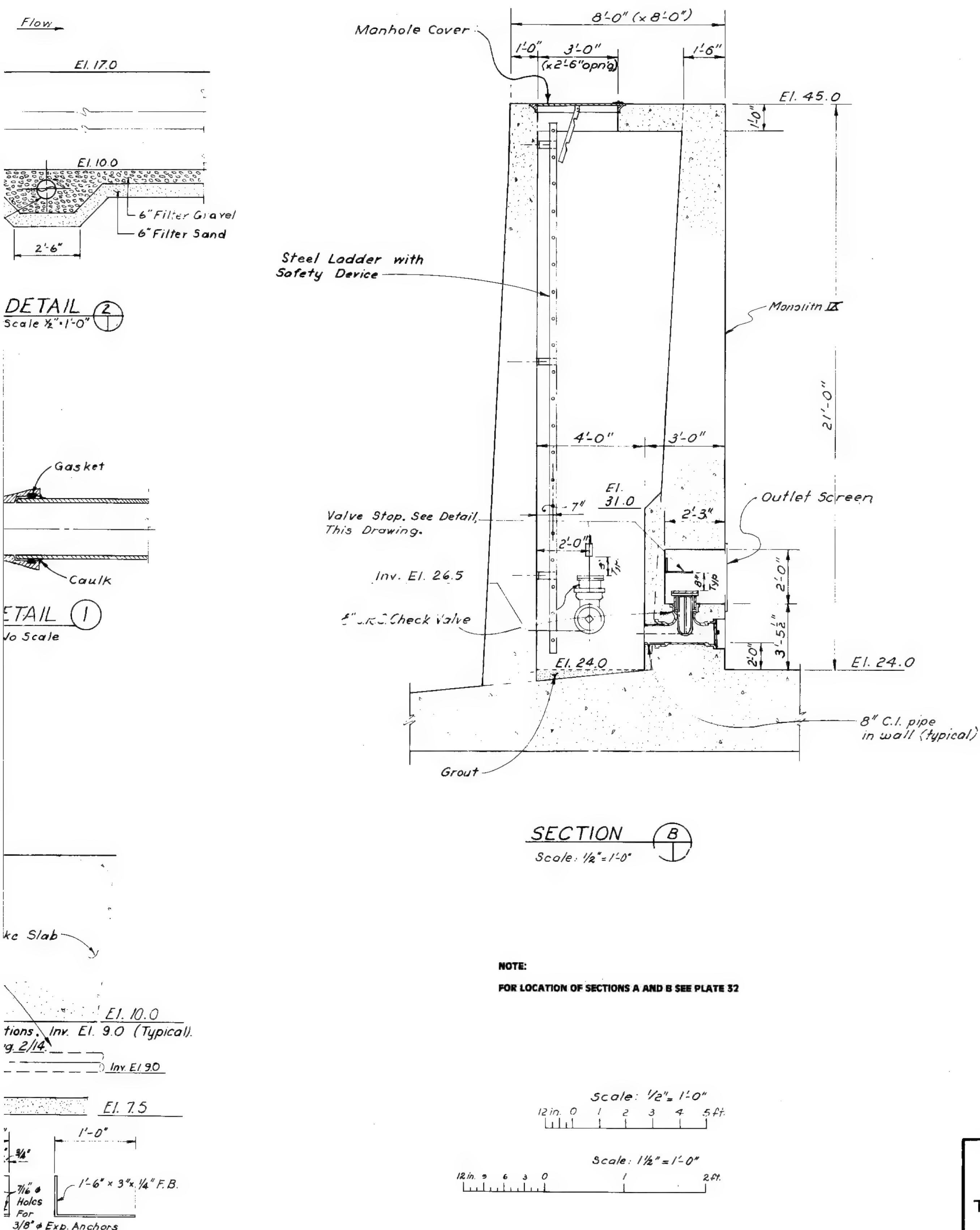


DETAIL 2
Scale ½" = 1'-0"

DETAIL 1
No Scale

SECTION A
Scale : ½" = 1'-0"

VALVE STOP DETAIL
Scale : 1½" = 1'-0"



SECTION B

Scale: ½" = 1'-0"

NOTE:

FOR LOCATION OF SECTIONS A AND B SEE PLATE 32

Scale: ½" = 1'-0"

12 in. 0 1 2 3 4 5 ft.

Scale: 1½" = 1'-0"

12 in. 9 6 3 0 1 2 ft.

TENSAS BA

RED RIVER BACKWA

LOUISIANA

TENSAS-COCODRIE P

AND DRAINAGE S

FOUNDATION

PUMPING PLANT

COLLECTOR SYSTE

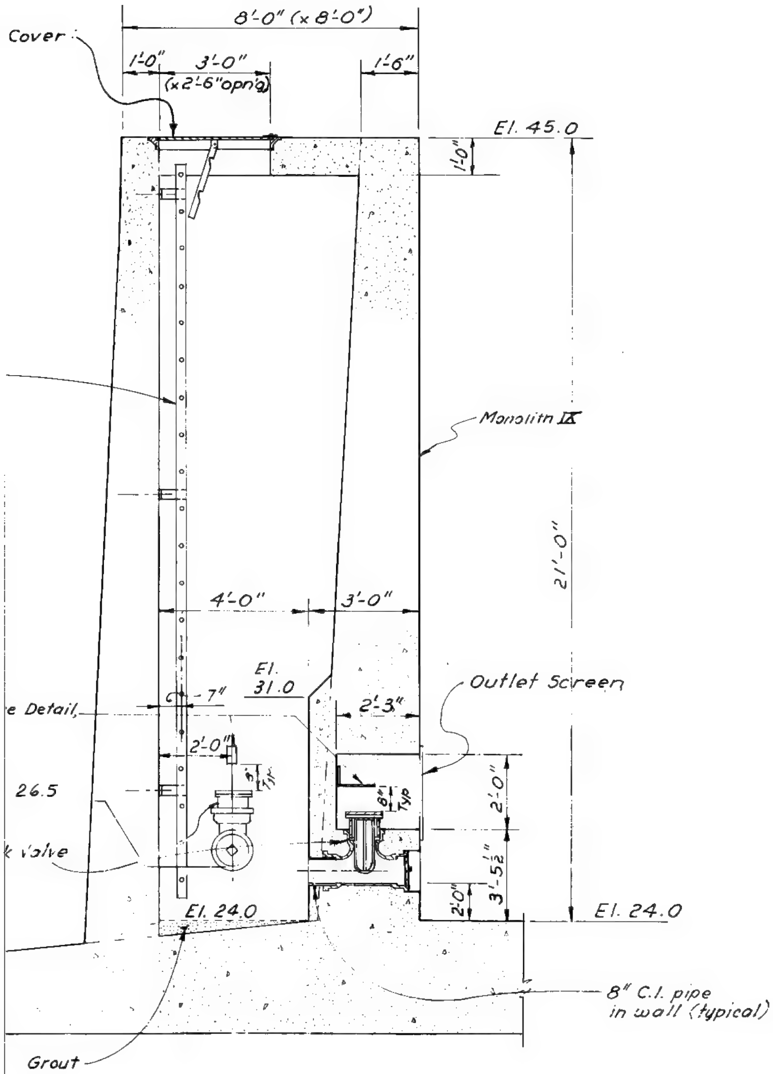
SCALE AS SH

U. S. ARMY ENGINEER DIS

CORPS OF ENG

VICKSBURG, MIS

DATE: AUGUST 1996

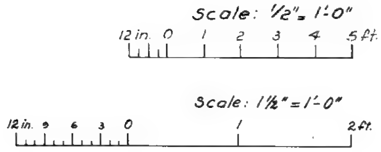


SECTION B

Scale: 1/2" = 1'-0"

NOTE:

FOR LOCATION OF SECTIONS A AND B SEE PLATE 32



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

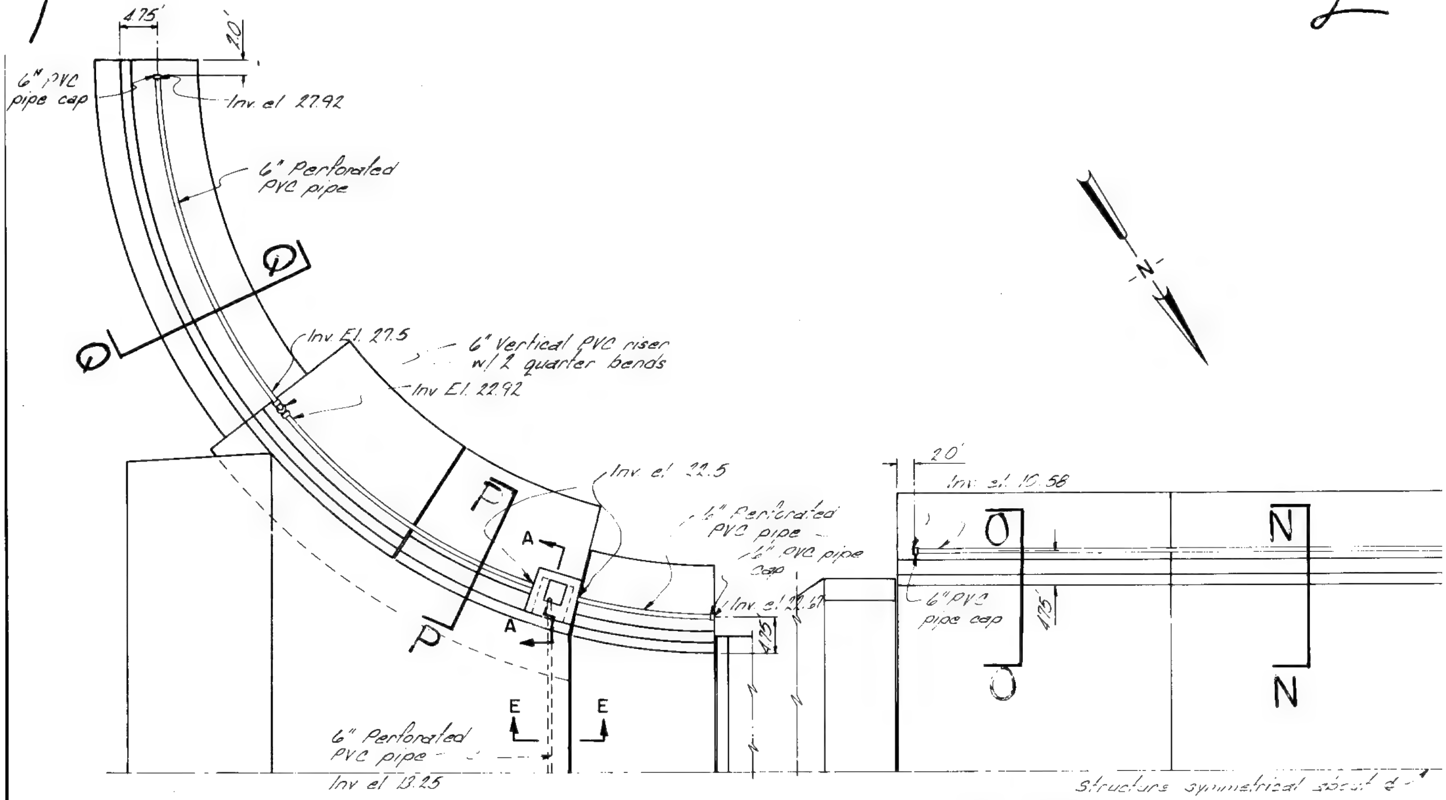
FOUNDATION REPORT

PUMPING PLANT DRAINAGE COLLECTOR SYSTEM - SECTIONS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

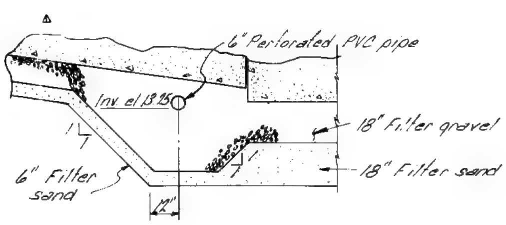
1

2



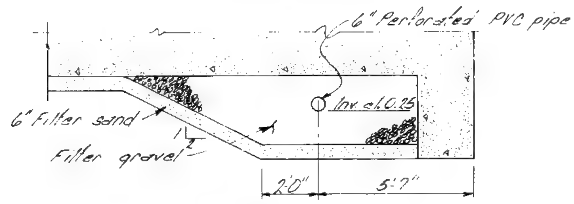
HALF-PLAN

SCALE: 1 IN = 10 FT.



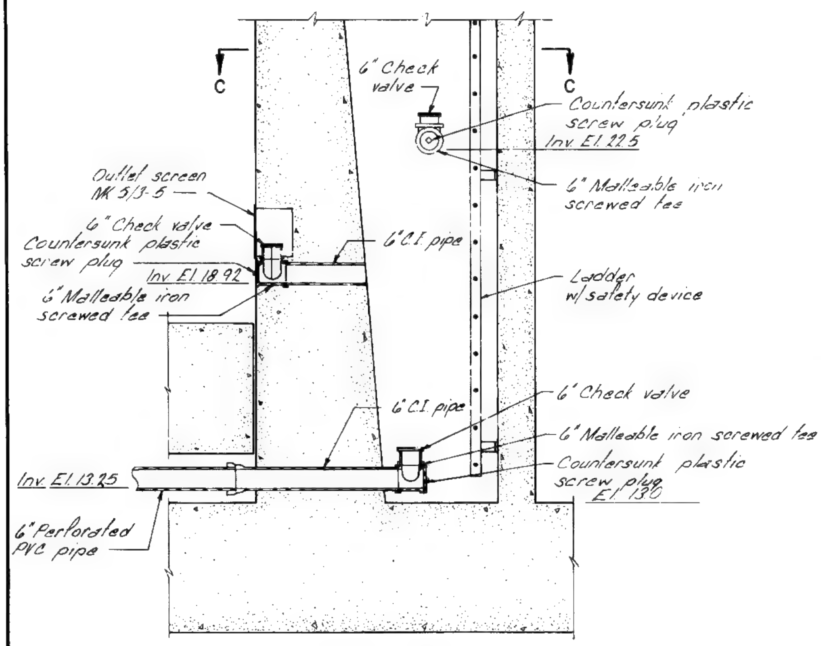
SECTION E-E

SCALE: 3/8 IN. = 1 FT.



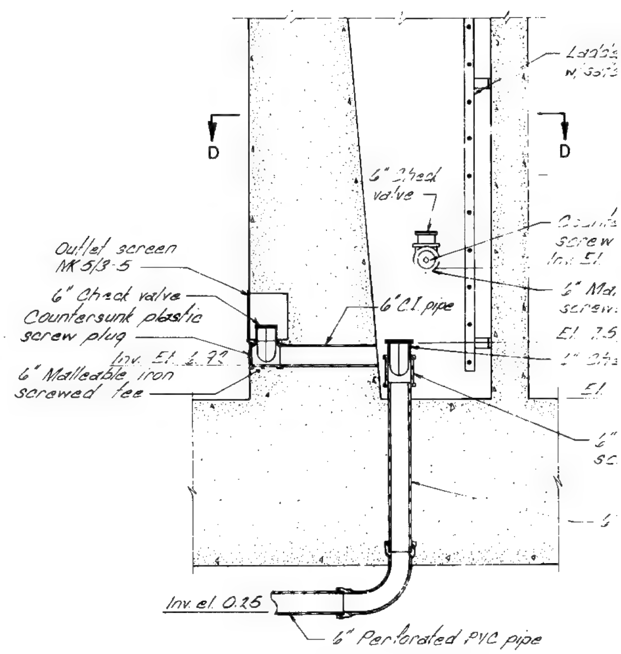
SECTION F-F

SCALE: 3/8 IN. = 1 FT.



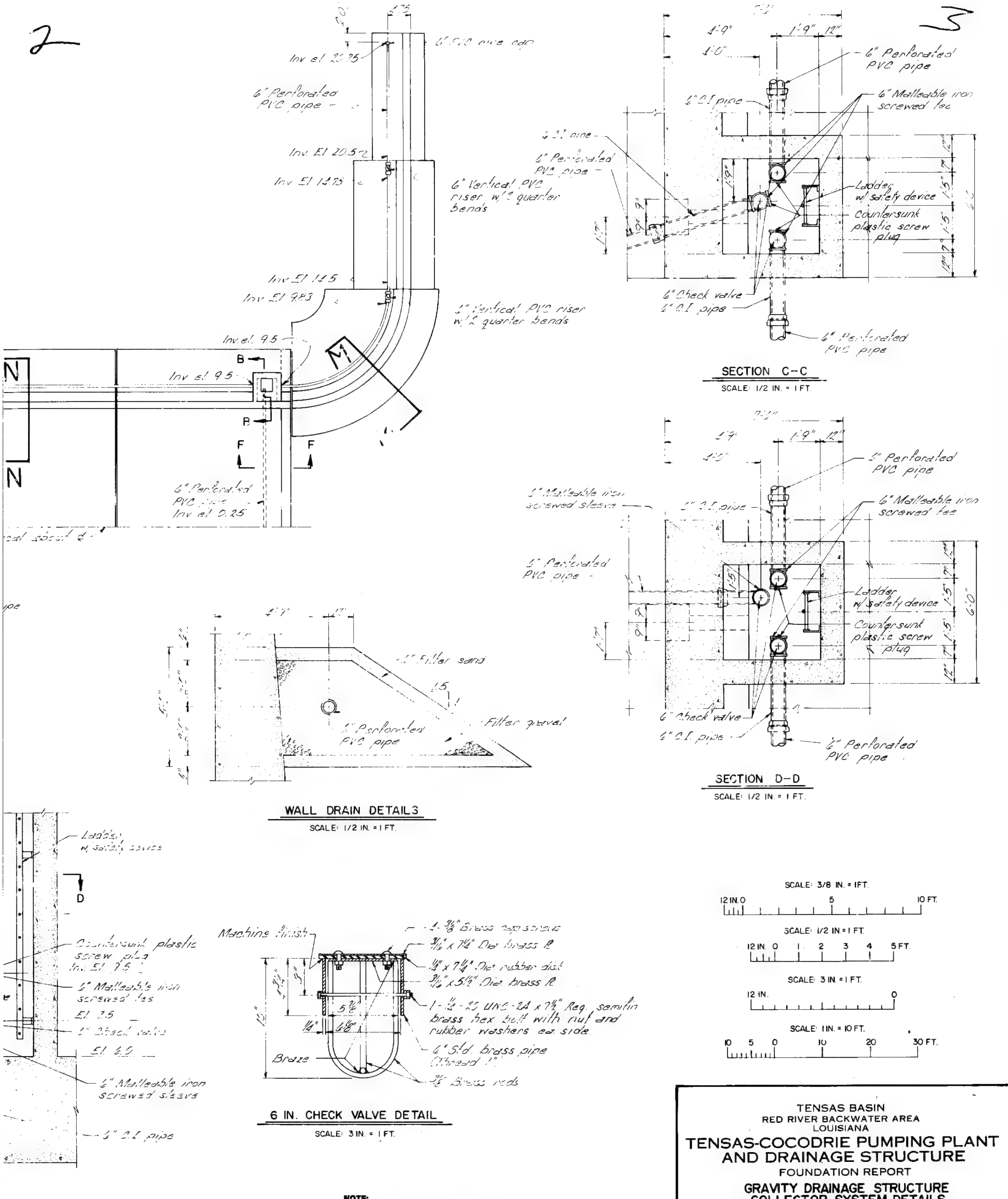
SECTION A-A

SCALE: 1/2 IN. = 1 FT.



SECTION B-B

SCALE: 1/2 IN. = 1 FT.



SECTION C–C

SCALE: 1/2 IN. = 1 FT.

SECTION D–D

SCALE: 1/2 IN. = 1 FT.

WALL DRAIN DETAILS

SCALE: 1/2 IN. = 1 FT.

6 IN. CHECK VALVE DETAIL

SCALE: 3 IN. = 1 FT.

SCALE: 3/8 IN. = 1 FT.

SCALE: 1/2 IN. = 1 FT.

SCALE: 3 IN. = 1 FT.

SCALE: 1 IN. = 10 FT.

NOTE:
FOR SECTIONS M-M THRU Q-Q SEE PLATE 35

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

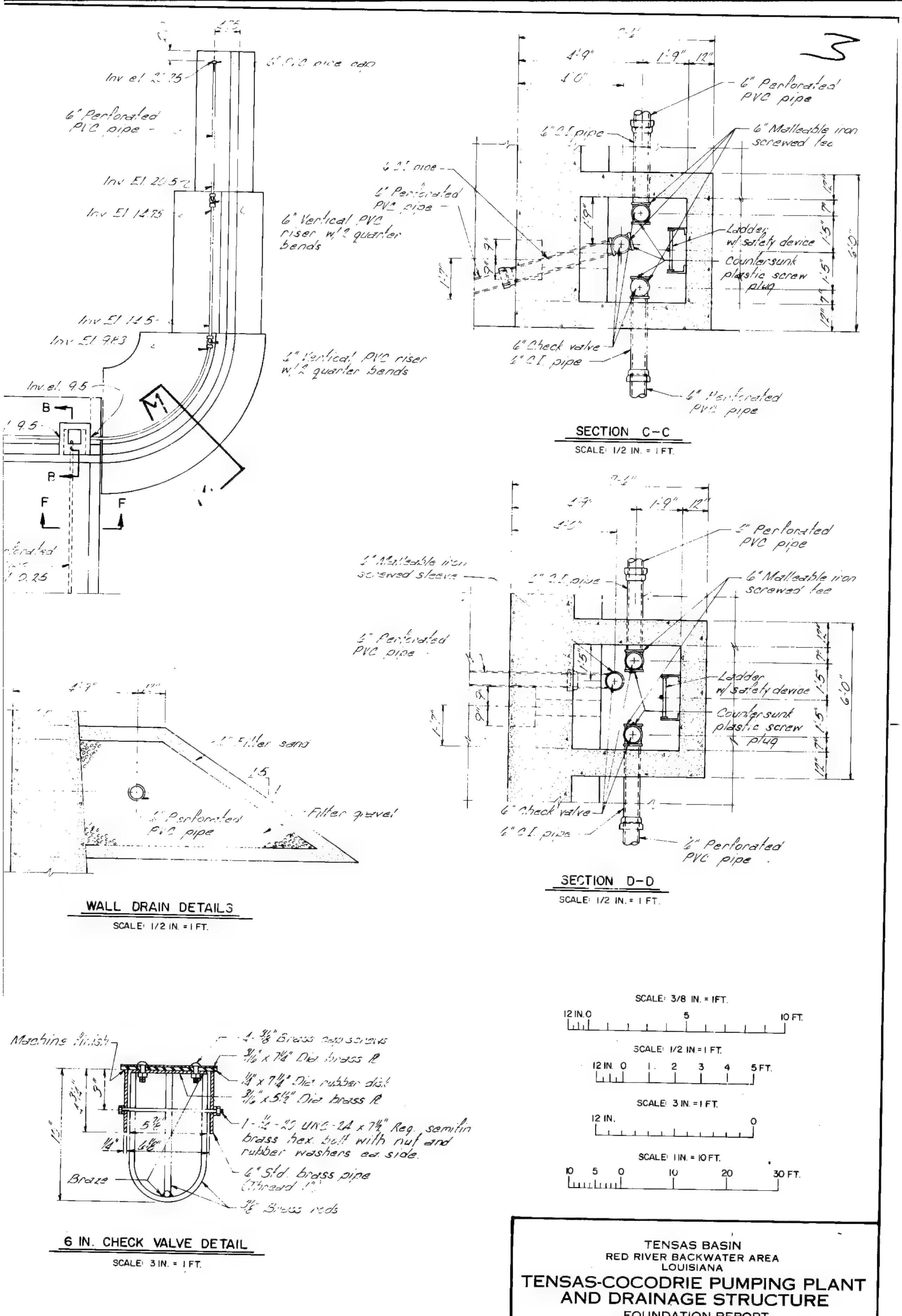
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

GRAVITY DRAINAGE STRUCTURE
COLLECTOR SYSTEM DETAILS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37



NOTE:
FOR SECTIONS M-M THRU O-O SEE PLATE 35

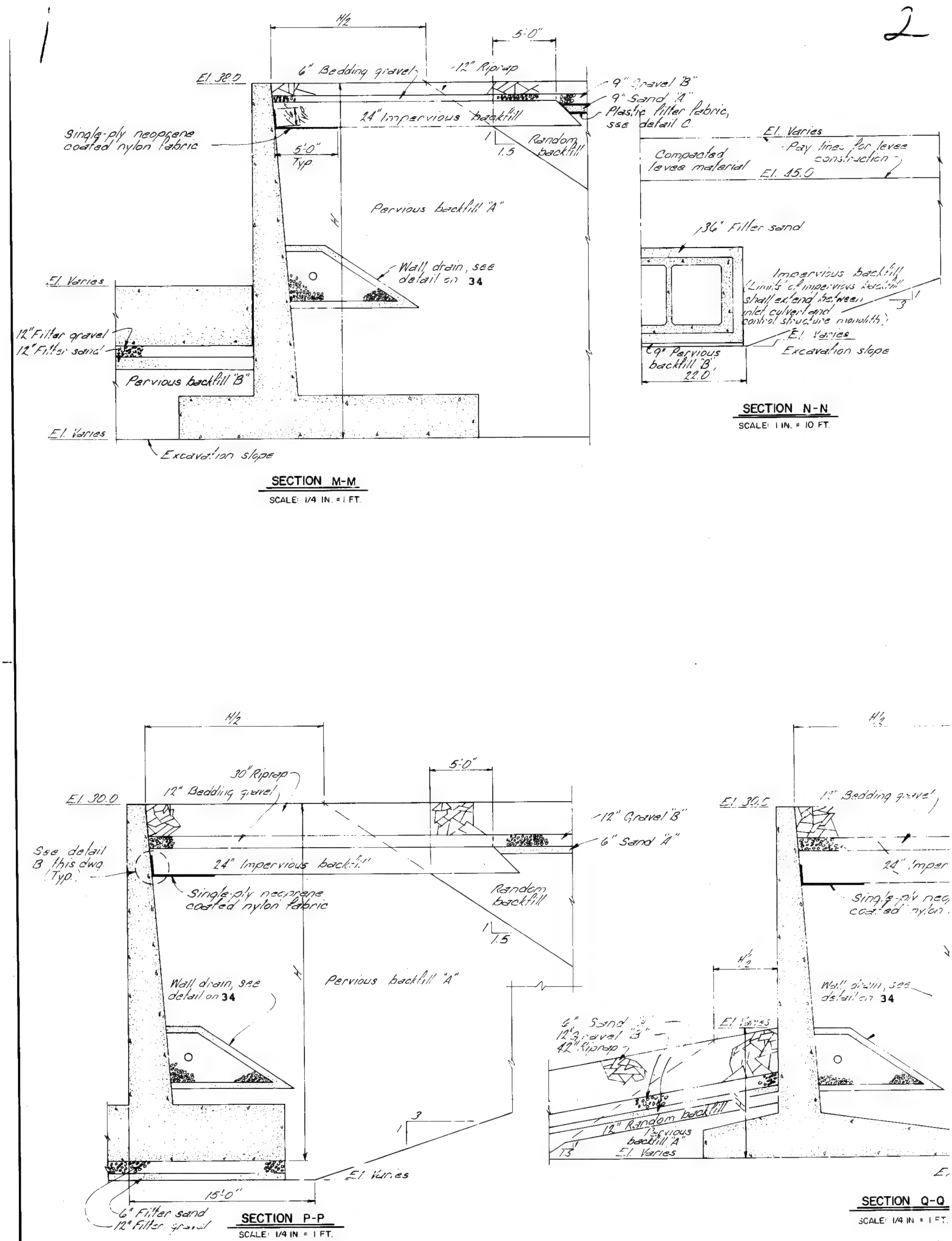
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

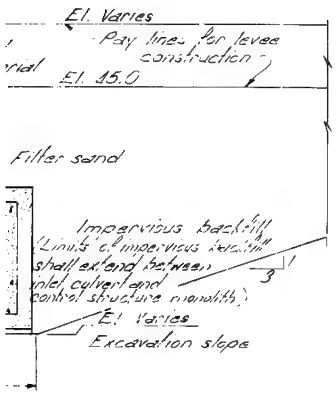
GRAVITY DRAINAGE STRUCTURE COLLECTOR SYSTEM DETAILS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

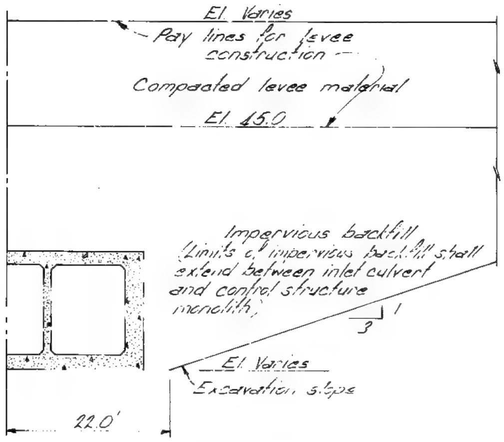


1
2
H/2
5'-0"
El. 38.0
6" Bedding gravel
12" Riprap
9" Gravel "B"
9" Sand "A"
Plastic filter fabric, see detail C
24" Impervious backfill
Single-ply neoprene coated nylon fabric
5'-0" Typ.
Random backfill
1.5
Pervious backfill "A"
Wall drain, see detail on 34
El. Varies
12" Filter gravel
12" Filter sand
Pervious backfill "B"
El. Varies
Excavation slope
SECTION M-M
SCALE: 1/4 IN. = 1 FT.
El. Varies
Pay lines for levee construction
Compacted levee material
El. 45.0
36" Filter sand
Impervious backfill (Limits of impervious backfill shall extend between inlet culvert and control structure monolith.)
3
El. Varies
Excavation slope
℄ 9" Pervious backfill "B"
22.0'
SECTION N-N
SCALE: 1 IN. = 10 FT.
H/2
30" Riprap
12" Bedding gravel
5'-0"
El. 30.0
12" Gravel "B"
6" Sand "A"
See detail B this dwg. (Typ.)
24" Impervious backfill
Single-ply neoprene coated nylon fabric
Random backfill
1.5
H
Pervious backfill "A"
Wall drain, see detail on 34
3
El. Varies
15'-0"
6" Filter sand
12" Filter gravel
SECTION P-P
SCALE: 1/4 IN. = 1 FT.
H/2
El. 30.0
12" Bedding gravel
24" Imper
Single-ply neo coated nylon
H/2
Wall drain, see detail on 34
6" Sand "A"
12" Gravel "B"
42" Riprap
El. Varies
12" Random backfill
Pervious backfill "A"
El. Varies
1.5
SECTION Q-Q
SCALE: 1/4 IN. = 1 FT.

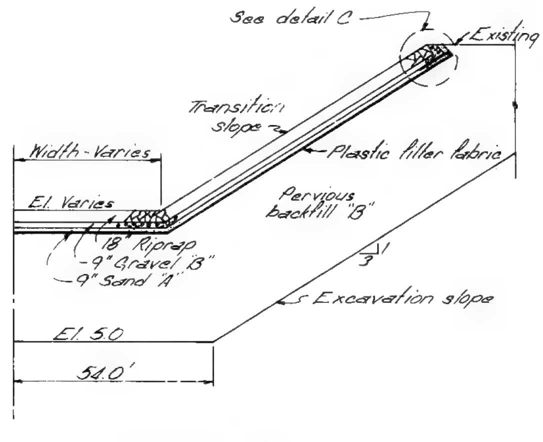
2



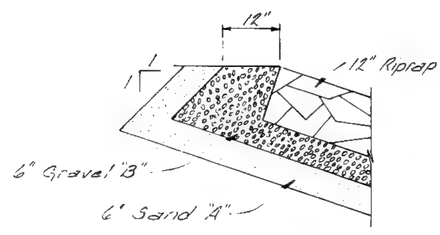
SECTION N-N
SCALE: 1 IN. = 10 FT.



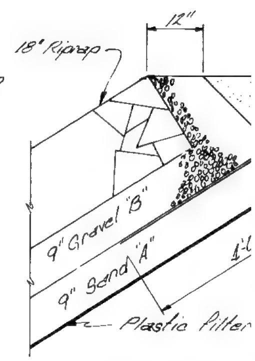
SECTION O-O
SCALE: 1 IN. = 10 FT.



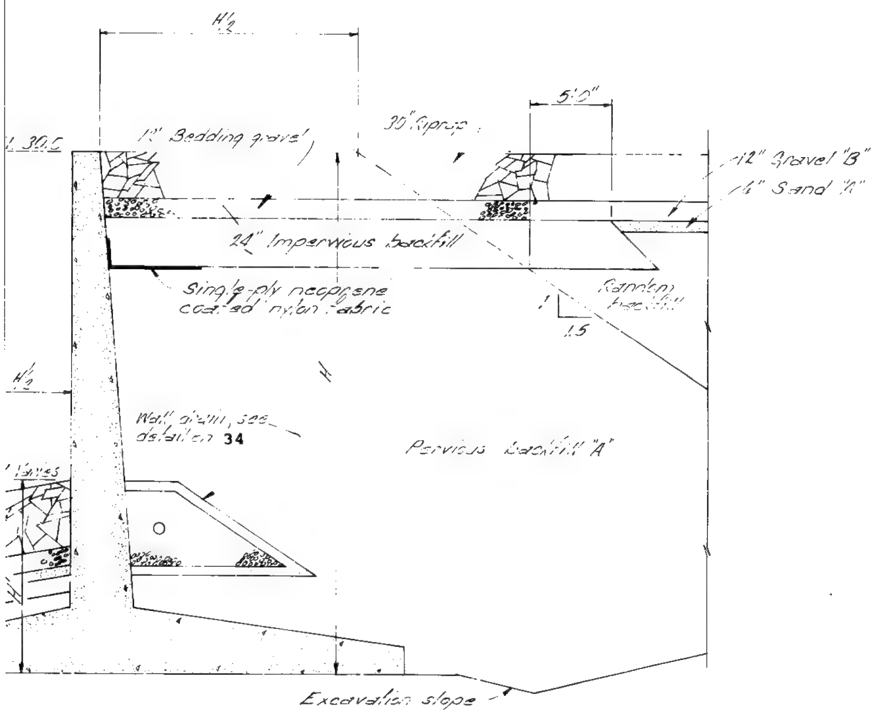
SECTION R-R
SCALE: 1 IN. = 20 FT. H.
1 IN. = 10 FT. V.



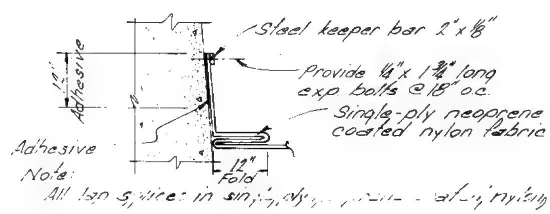
DETAIL A
SCALE: 3/4 IN. = 1 FT.



DETAIL C
SCALE: 3/4 IN. = 1 FT.



SECTION Q-Q
SCALE: 1/4 IN. = 1 FT.



DETAIL B
SCALE: 3/4 IN. = 1 FT.

SCALE: 1 IN. = 20 FT.
20 10 0 20 40 60

SCALE: 3/4 IN. = 1 FT.
12 IN. 0 1 2 3 4

SCALE: 1 IN. = 10 FT.
10 5 0 10 20 30

SCALE: 1/4 IN. = 1 FT.
12 IN. 0 5 10 15

NOTE:
FOR LOCATION OF SECTIONS M-M THRU Q-Q SEE PLATE 34

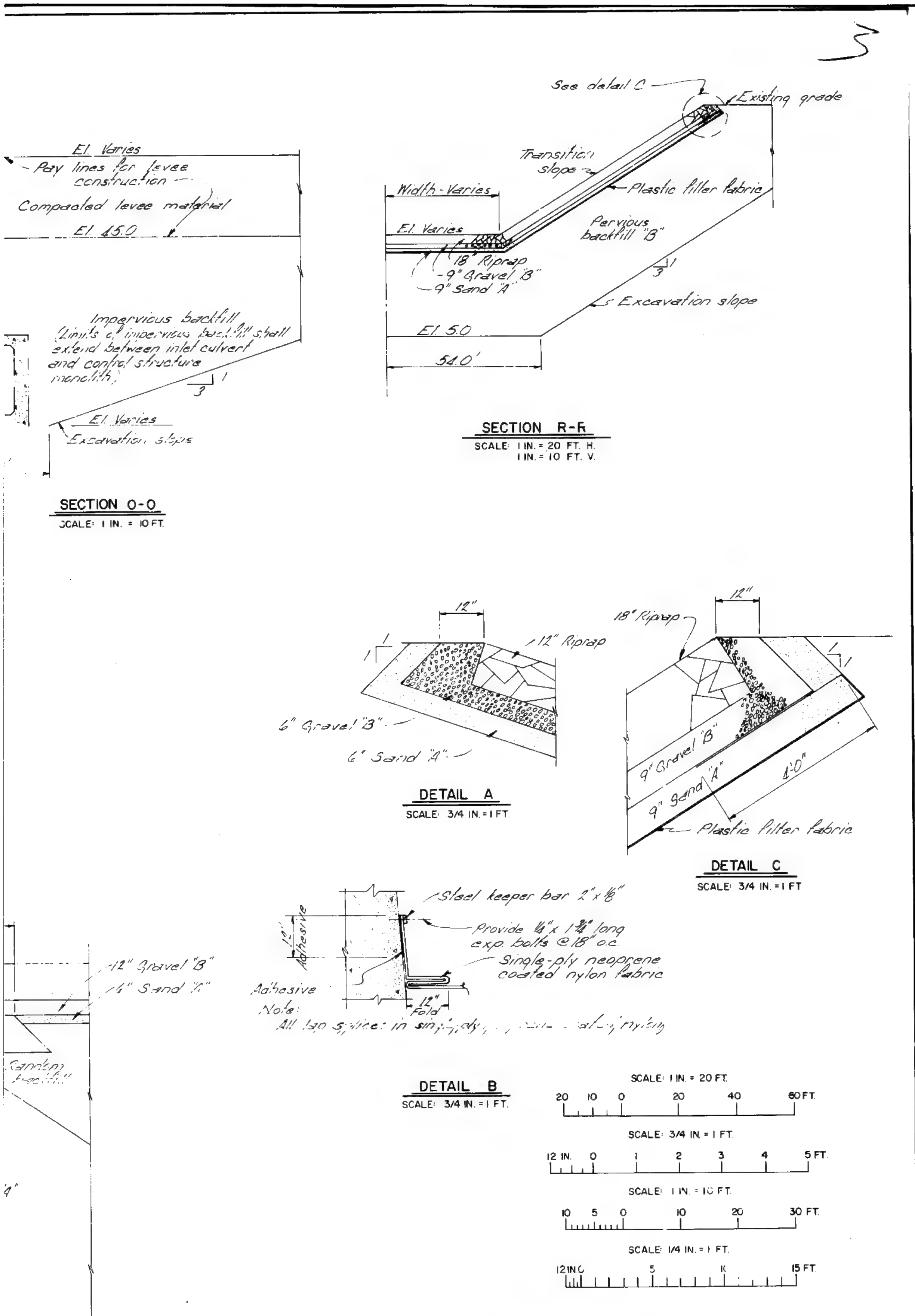
TENSAS BASIN
RED RIVER BACKWATER ARE
LOUISIANA

TENSAS-COCODRIE PUMPI
AND DRAINAGE STRUC

FOUNDATION REPORT

GRAVITY DRAINAGE STRUC
BACKFILL SECTIONS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VI
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996



NOTE:
FOR LOCATION OF SECTIONS M-M THRU O-O
SEE PLATE 34

TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

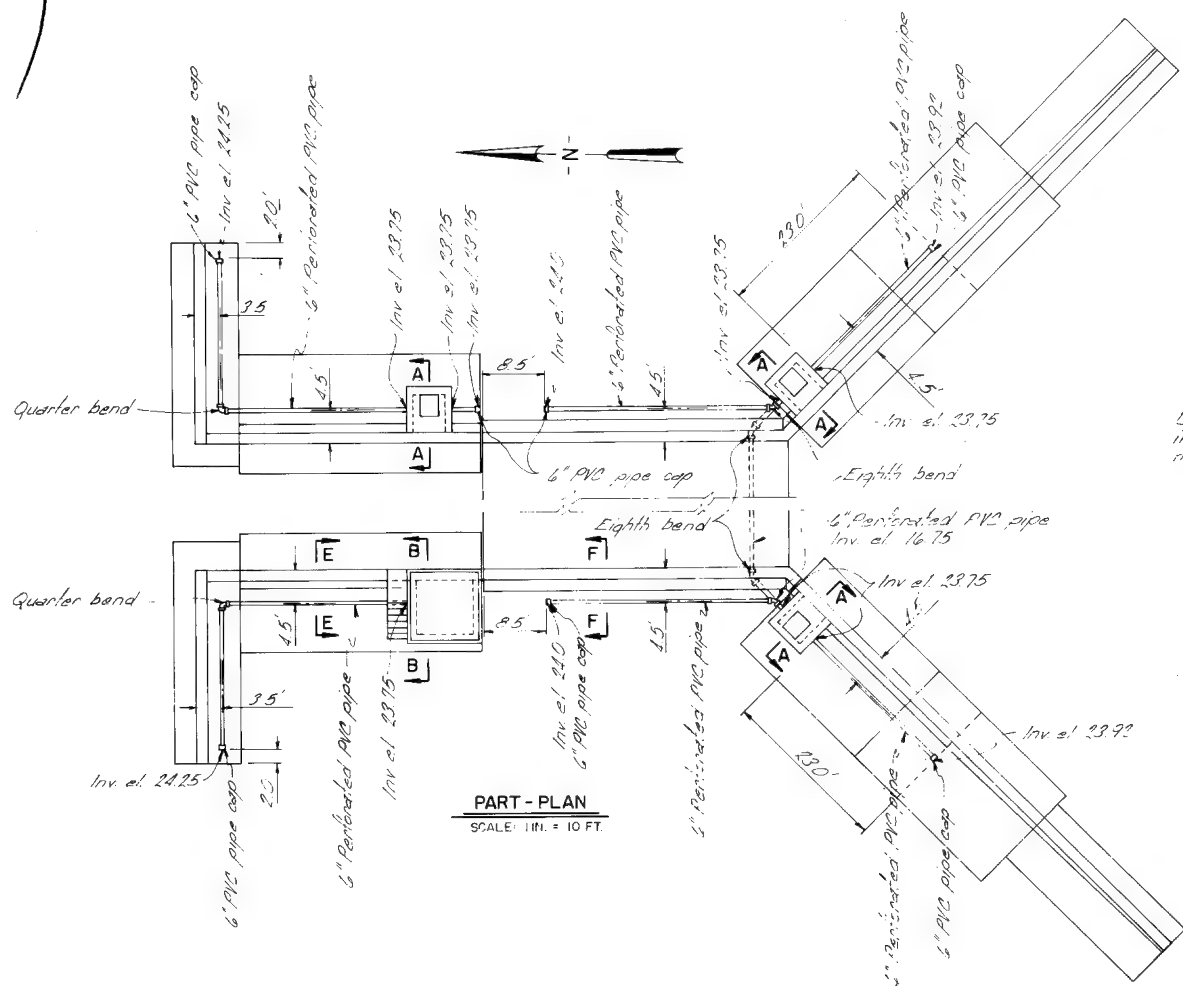
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

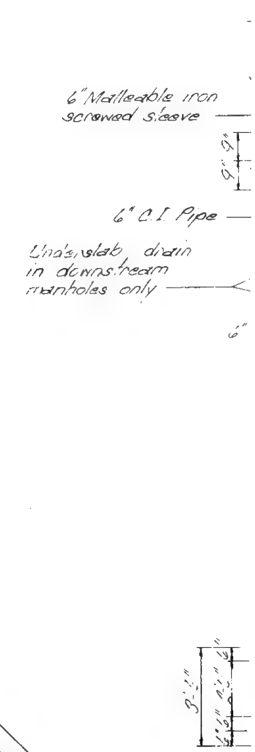
GRAVITY DRAINAGE STRUCTURE BACKFILL SECTIONS

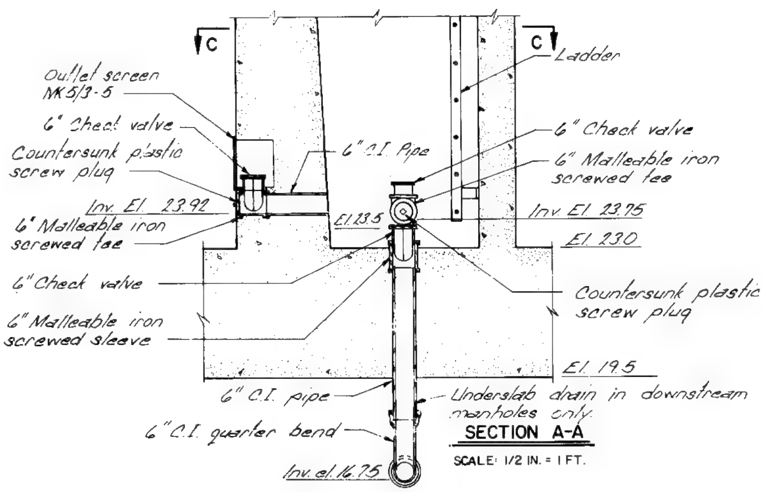
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37

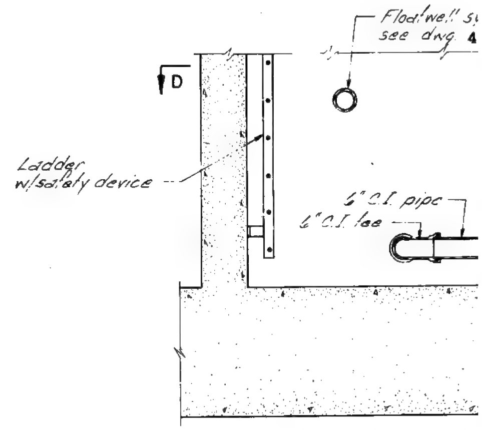


PART - PLAN
SCALE: 1 IN. = 10 FT.



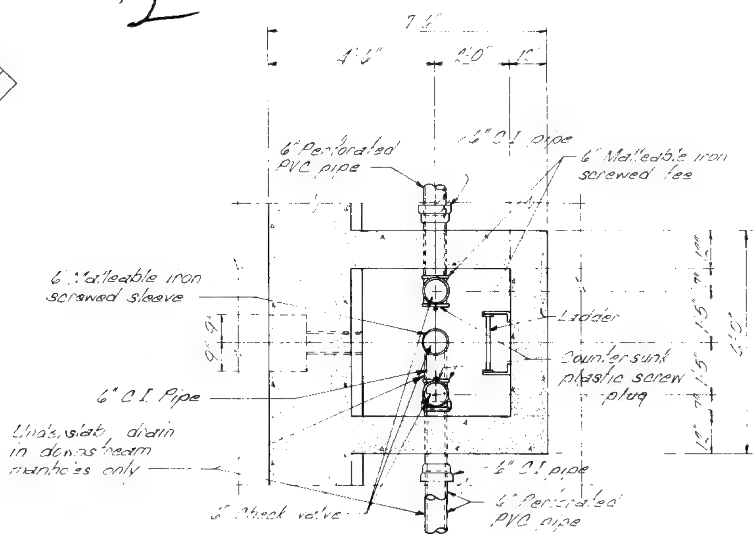


SECTION A-A
SCALE: 1/2 IN. = 1 FT.

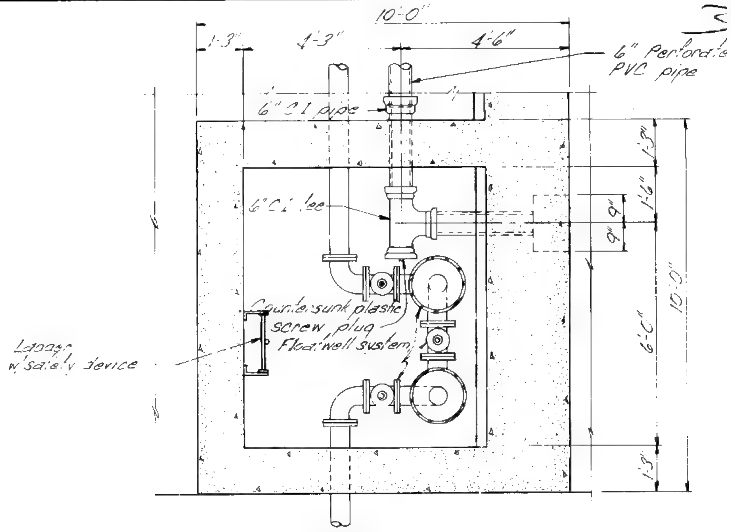


SECTION B-B
SCALE: 1/2 IN. = 1 FT.

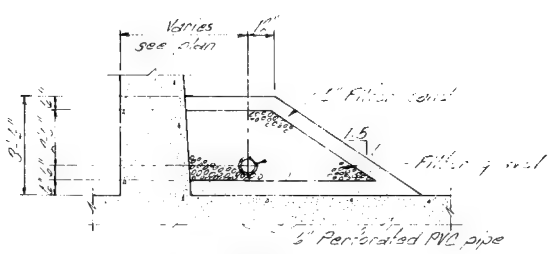
2



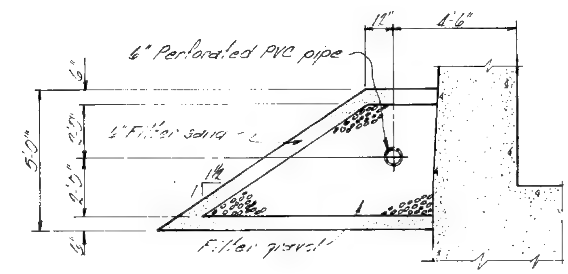
SECTION C-C
SCALE: 1/2 IN. = 1 FT.



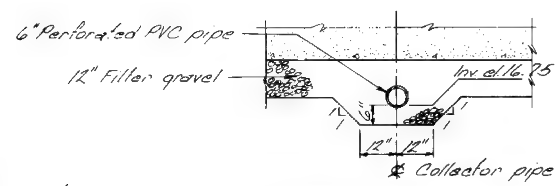
SECTION D-D
SCALE: 1/2 IN. = 1 FT.



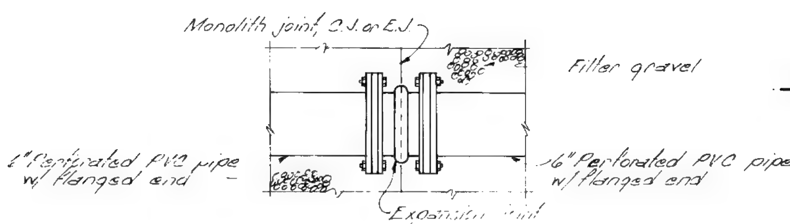
SECTION E-E
SCALE: 3/8 IN. = 1 FT.



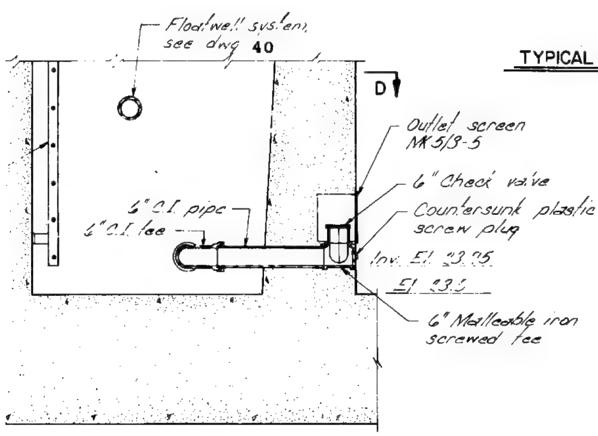
SECTION F-F
SCALE: 3/8 IN. = 1 FT.



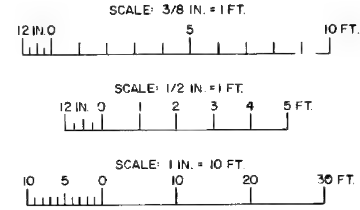
UNDERSLAB DRAIN DETAIL
SCALE: 1/2 IN. = 1 FT.



TYPICAL UNDERSLAB DRAIN DETAIL AT WEIR MONOLITH JOINTS
SCALE: NONE



SECTION B-B
SCALE: 1/2 IN. = 1 FT.



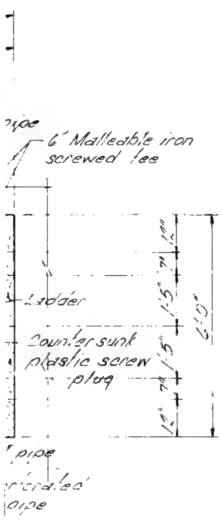
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

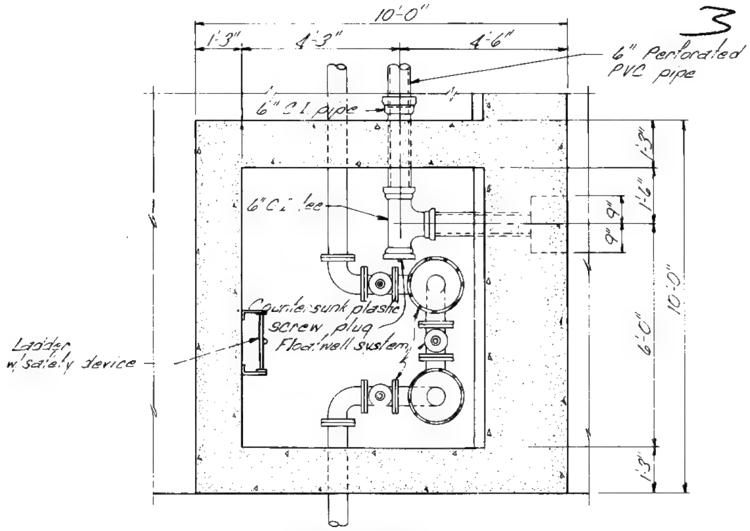
TENSAS-COCODRIE PUMPING PL
AND DRAINAGE STRUCTURE
FOUNDATION REPORT

UPPER WEIR COLLECTOR SYSTEM DETAI

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-

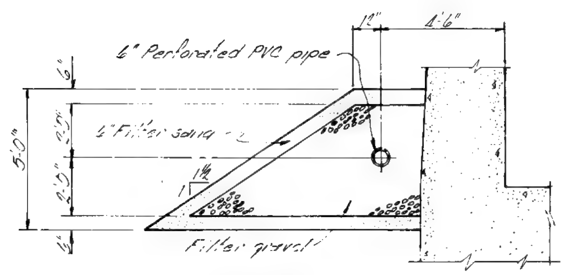
PL





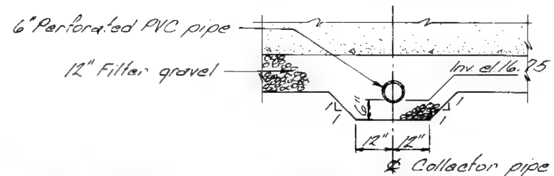
SECTION D-D

SCALE: 1/2 IN. = 1 FT.



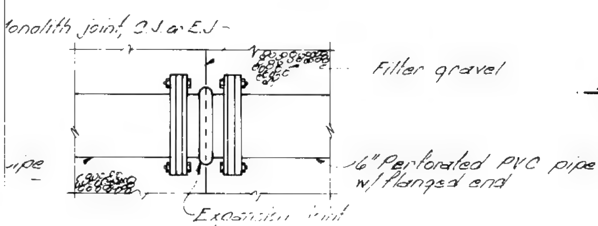
SECTION F-F

SCALE: 3/8 IN. = 1 FT.



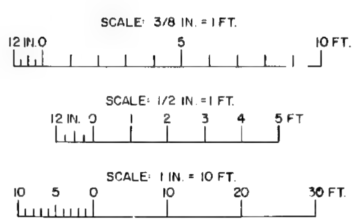
UNDERSLAB DRAIN DETAIL

SCALE: 1/2 IN.=1 FT.



AL UNDERSLAB DRAIN DETAIL AT WEIR MONOLITH JOINTS

SCALE: NONE



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

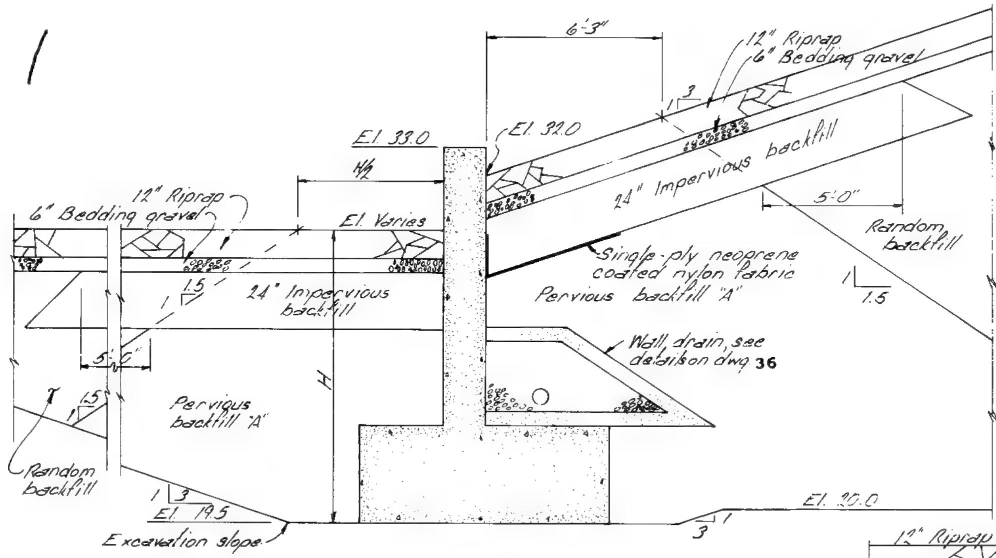
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

UPPER WEIR COLLECTOR SYSTEM DETAILS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37

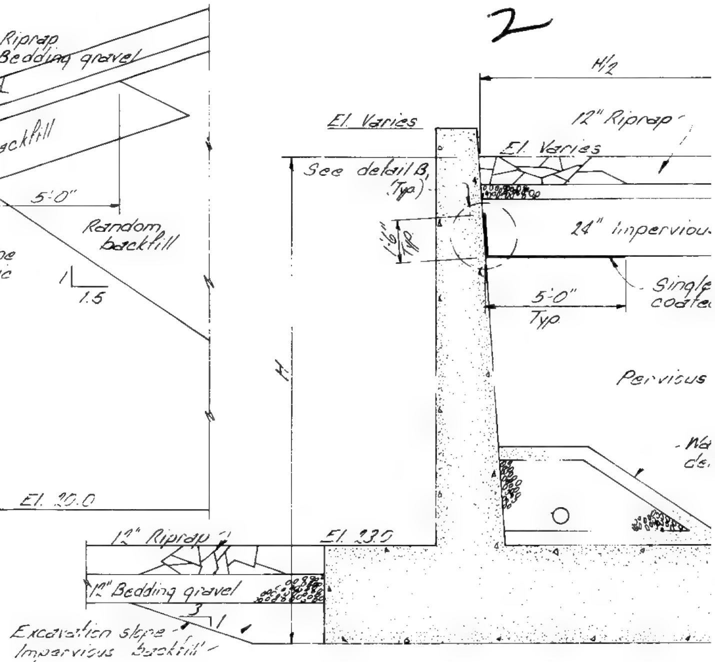
1



SECTION B-B

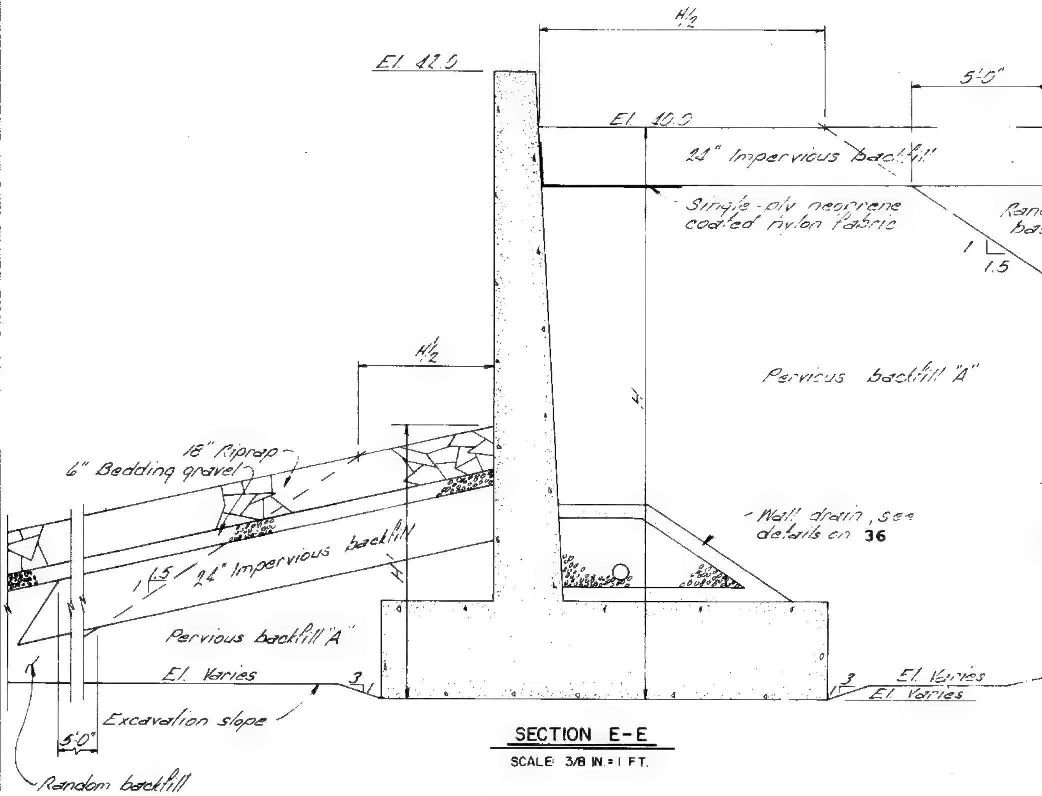
SCALE: 3/8 IN. = 1 FT.

2



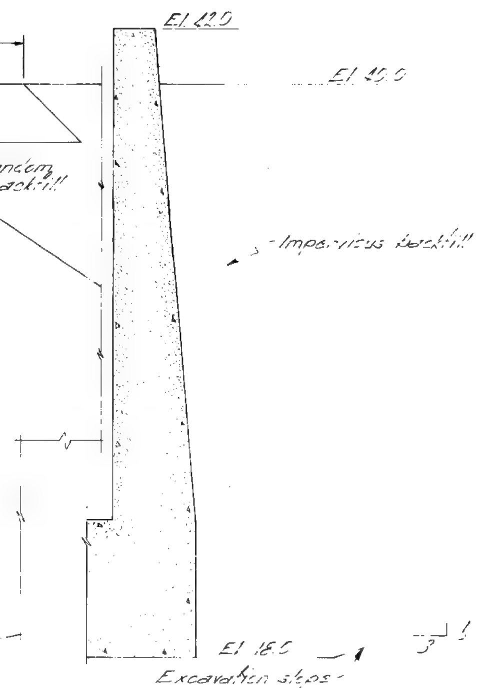
SECTION C-C

SCALE: 3/8 IN. = 1 FT.



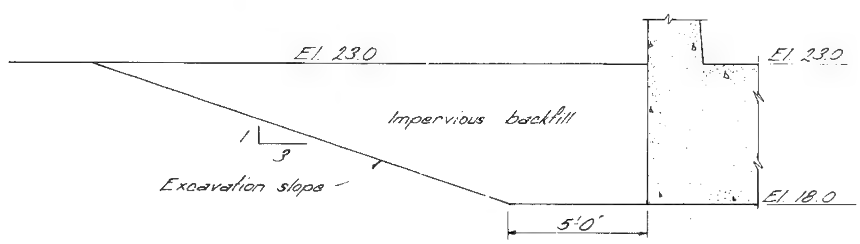
SECTION E-E

SCALE: 3/8 IN. = 1 FT.



SE

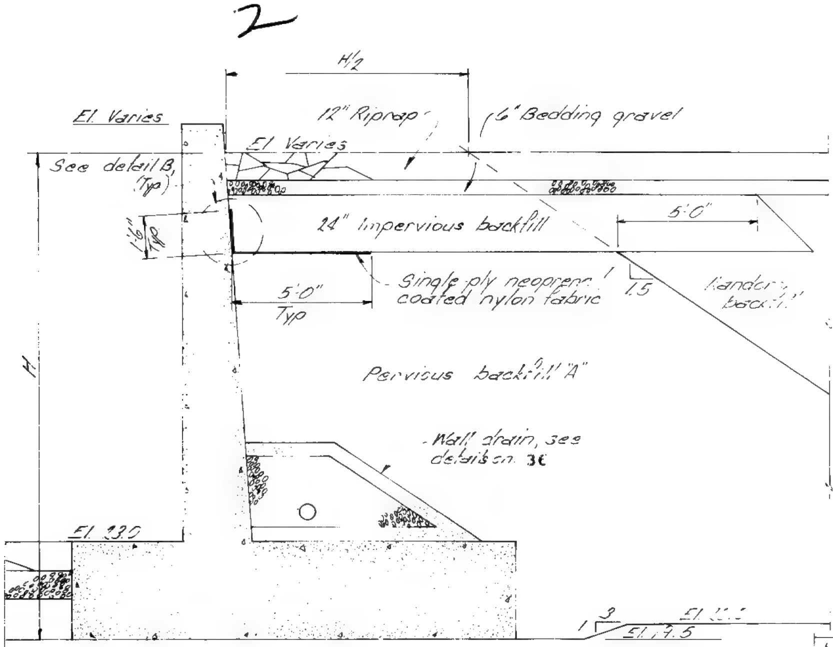
SCA



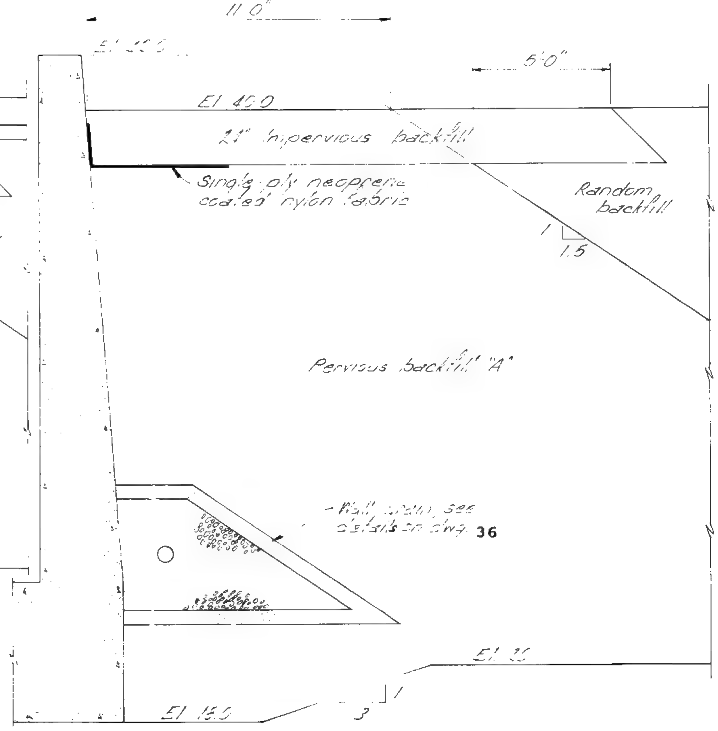
SECTION H-H

SCALE: 3/8 IN. = 1 FT.

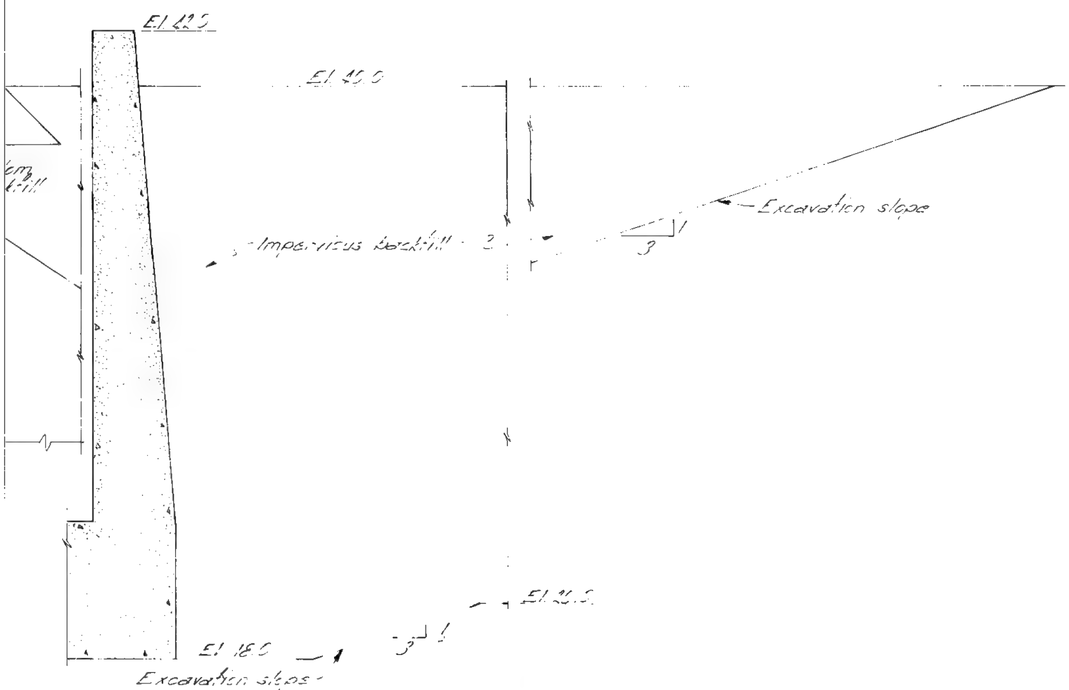
2



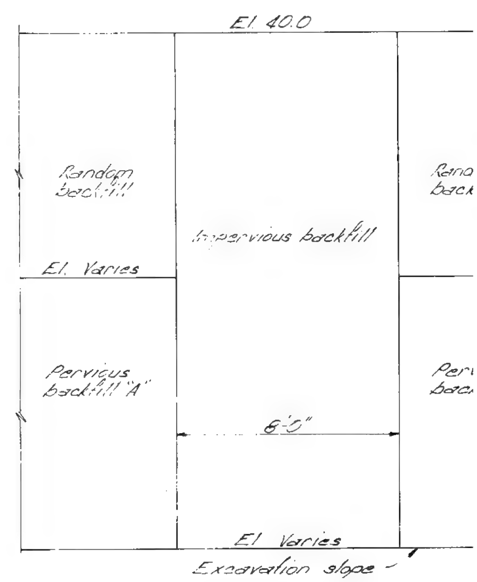
SECTION C-C
SCALE: 3/8 IN. = 1 FT.



SECTION D-D
SCALE: 3/8 IN. = 1 FT.



SECTION F-F
SCALE: 3/8 IN. = 1 FT.



SECTION G-G
SCALE: 3/8 IN. = 1 FT.

SCALE: 3/8 IN. = 1 FT.

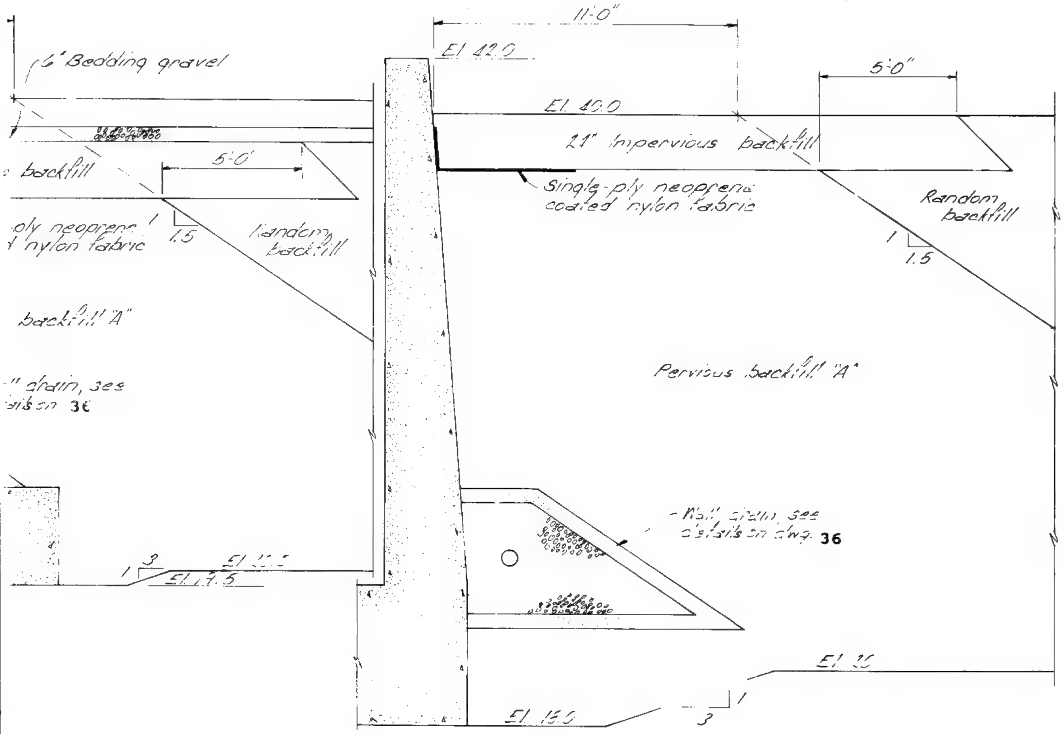
23.0

18.0

NOTE:
FOR LOCATION OF SECTIONS B-B, C-C, D-D, F-F, I-I, G-G AND H-H SEE PLATE 5

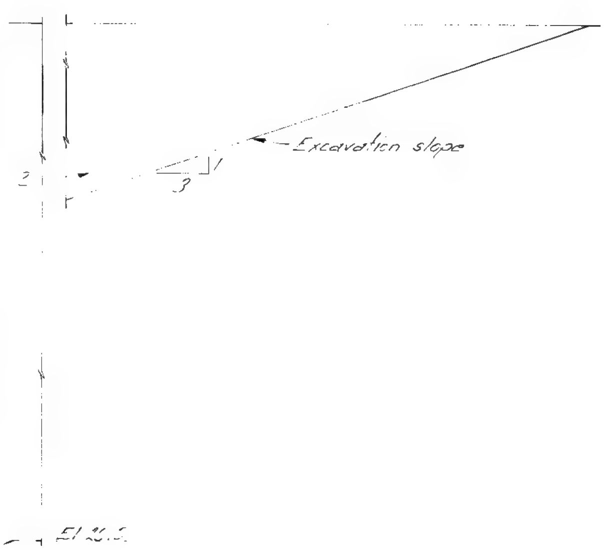
TENSAS BASIN
RED RIVER BACKWATER AR
LOUISIANA
TENSAS-COCODRIE PUMP
AND DRAINAGE STRU
FOUNDATION REPORT
UPPER WEIR BACKFILL SE
SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, V
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPP
DATE: AUGUST 1996

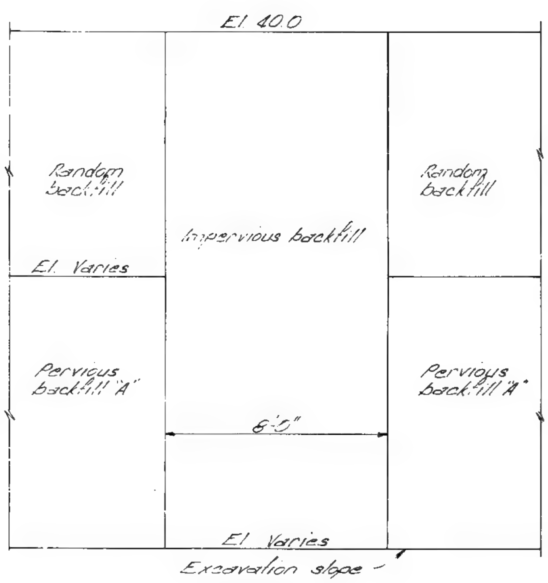
3



SECTION D-D

SCALE: 3/8 IN. = 1 FT.





SECTION G-G

SCALE: 3/8 IN. = 1 FT.

CTION F-F

E: 3/8 IN. = 1 FT.

SCALE: 3/8 IN. = 1 FT.

12IN.0 5 10FT.

NOTE:
FOR LOCATION OF SECTIONS B-B, C-C, D-D, E-E, I-I, G-G AND H-H SEE PLATE 5

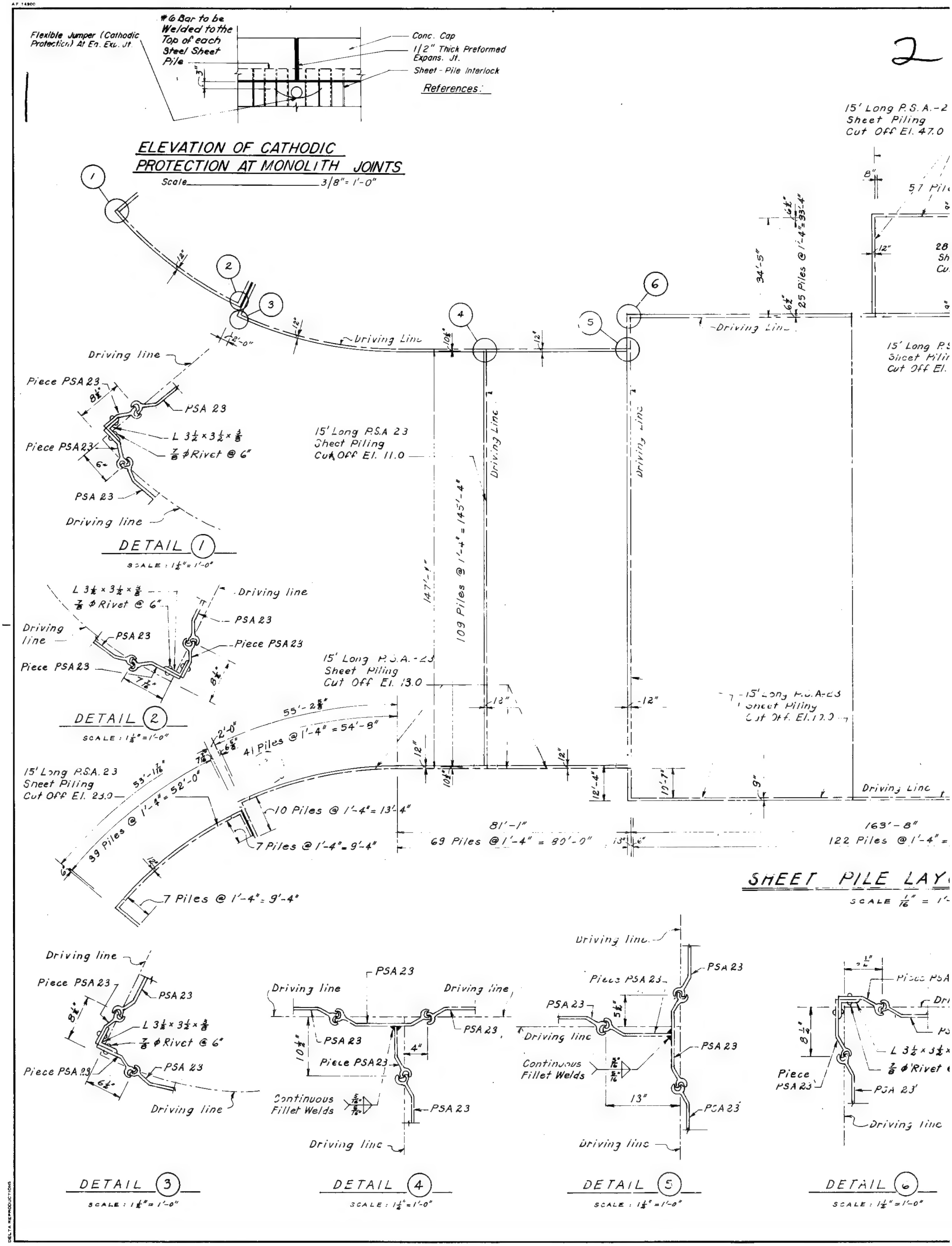
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

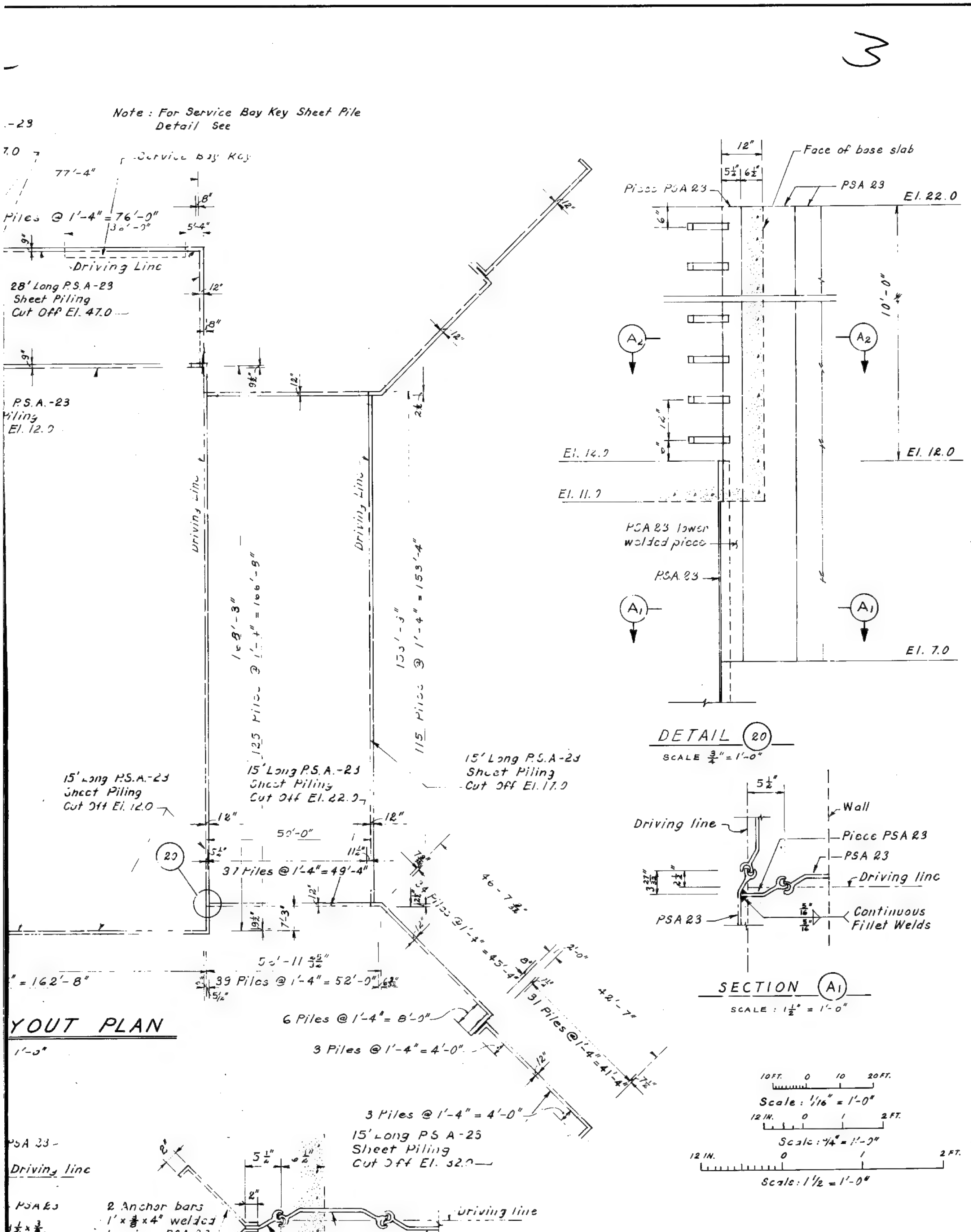
TENSAS-COCODRIE PUMPING PLANT
AND DRAINAGE STRUCTURE

FOUNDATION REPORT

UPPER WEIR BACKFILL SECTIONS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37


#6 Bar to be Welded to the Top of each Steel Sheet Pile
Flexible Jumper (Cathodic Protection) At En. Exp. Jt.
Conc. Cap
1/2" Thick Preformed Expans. Jt.
Sheet - Pile Interlock
References:
ELEVATION OF CATHODIC PROTECTION AT MONOLITH JOINTS
Scale 3/8" = 1'-0"
15' Long P.S.A.-23 Sheet Piling Cut Off El. 47.0
57 Pil
28
Driving Line
15' Long P.S.A 23 Sheet Piling Cut Off El. 11.0
109 Piles @ 1'-4" = 145'-4"
147'-1"
34'-5"
25 Piles @ 1'-4" = 33'-4"
15' Long P.S.A.-23 Sheet Piling Cut Off El. 13.0
15' Long P.S.A.-23 Sheet Piling Cut Off El. 17.0
15' Long P.S.A. 23 Sheet Piling Cut Off El. 23.0
55'-2 5/8"
41 Piles @ 1'-4" = 54'-8"
53'-1 1/16"
39 Piles @ 1'-4" = 52'-0"
10 Piles @ 1'-4" = 13'-4"
7 Piles @ 1'-4" = 9'-4"
7 Piles @ 1'-4" = 9'-4"
81'-1"
69 Piles @ 1'-4" = 80'-0"
163'-8"
122 Piles @ 1'-4" =
SHEET PILE LAY
SCALE 1/16" = 1'
Driving line
Piece PSA 23
PSA 23
L 3 1/2 × 3 1/2 × 3/8
7/8 ϕ Rivet @ 6"
DETAIL 1
SCALE: 1 1/2" = 1'-0"
DETAIL 2
SCALE: 1 1/2" = 1'-0"
Continuous Fillet Welds
DETAIL 3
SCALE: 1 1/2" = 1'-0"
DETAIL 4
SCALE: 1 1/2" = 1'-0"
DETAIL 5
SCALE: 1 1/2" = 1'-0"
DETAIL 6
SCALE: 1 1/2" = 1'-0"



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

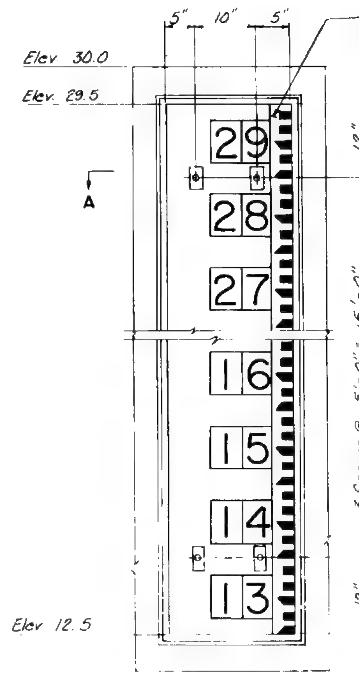
TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

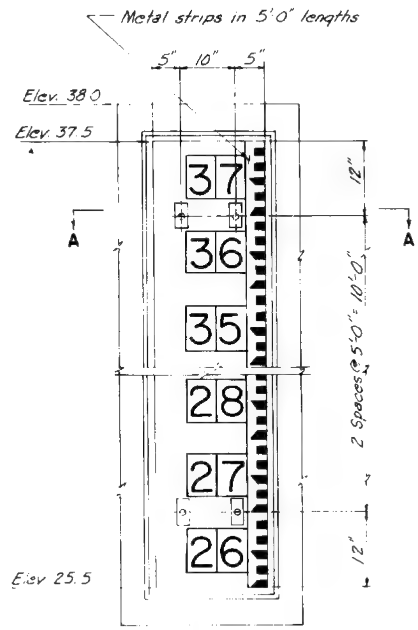
SHEET PILE LAYOUT AND DETAILS PUMPING PLANT

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37

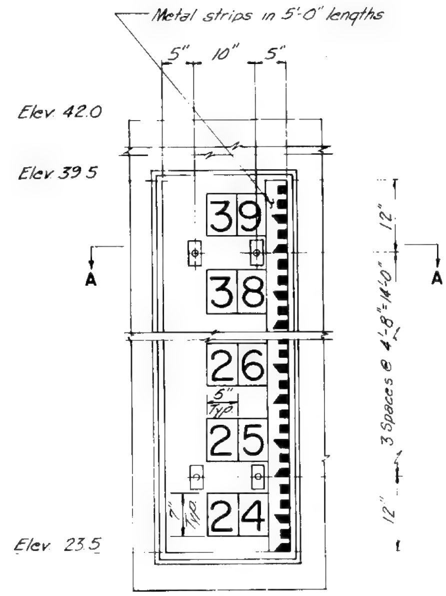


STAFF GAGE "A"



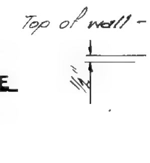
STAFF GAGE "B"

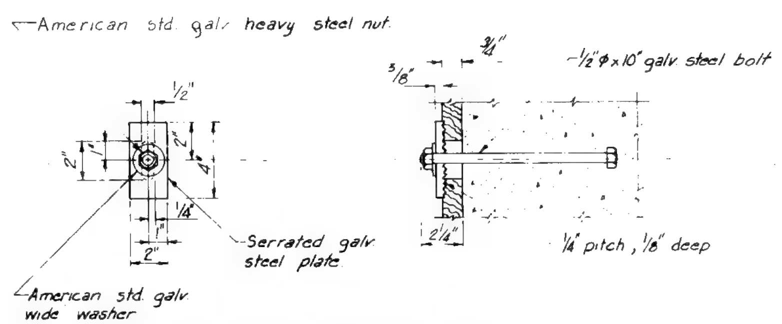
GRAVITY DRAINAGE STRUCTURE STAFF GAGES
SCALE: 1IN. = 1FT.



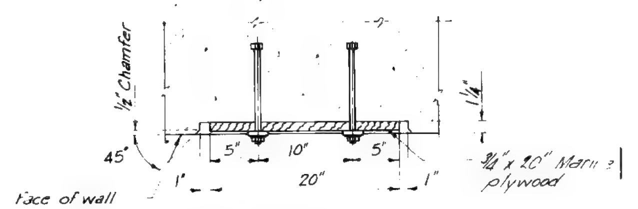
STAFF GAGE "C"

UPPER WEIR STAFF GAGE
SCALE: 1IN. = 1FT.

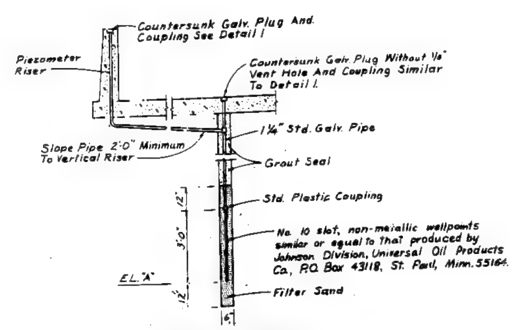




STAFF GAGE ANCHORAGE DETAIL
SCALE: 3IN. = 1FT.

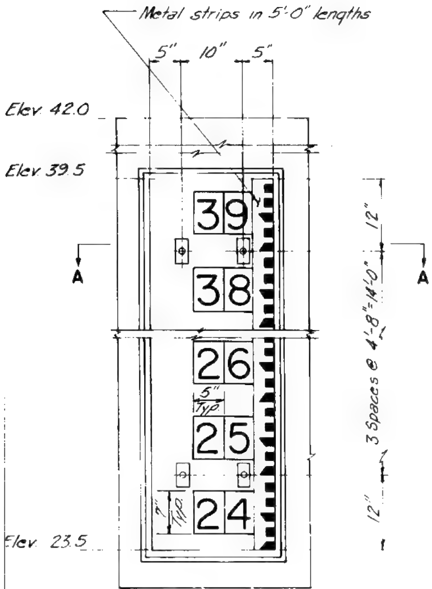


SECTION A-A
SCALE: 1-1/2IN. = 1FT.



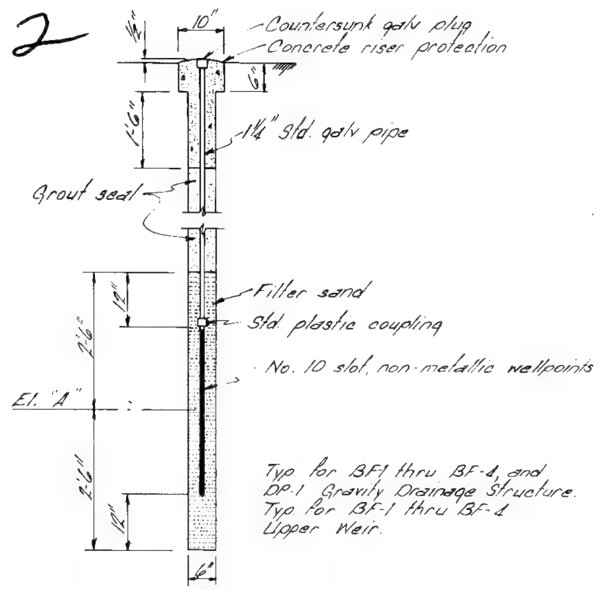
FOUNDATION PIEZOMETER INSTALLATION DETAIL
SCALE: 1/2" = 1FT.

2

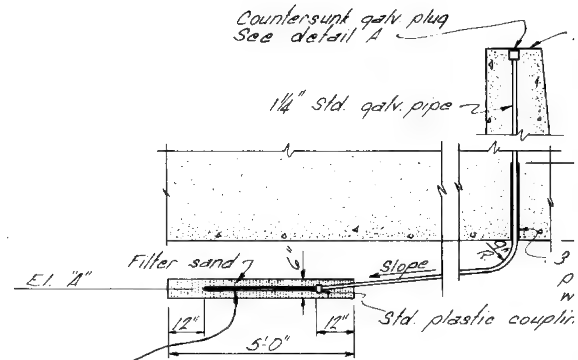


STAFF GAGE "C"

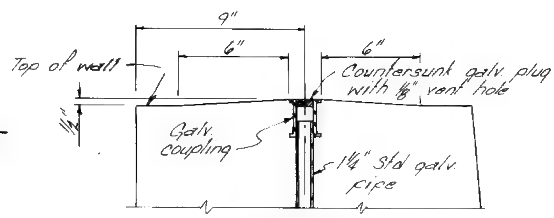
UPPER WEIR STAFF GAGE
SCALE: 1 IN. = 1 FT.



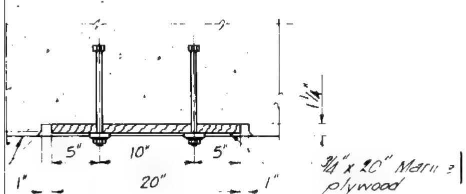
BACKFILL PIEZOMETER INSTALLATION DETAIL
SCALE: 3/4 IN. = 1 FT.



HORIZONTAL PIEZOMETER INSTALLATION DETAIL
SCALE: 1/2 IN. = 1 FT.



DETAIL A
SCALE: 3 IN. = 1 FT.



SECTION A-A
SCALE: 1-1/2 IN. = 1 FT.

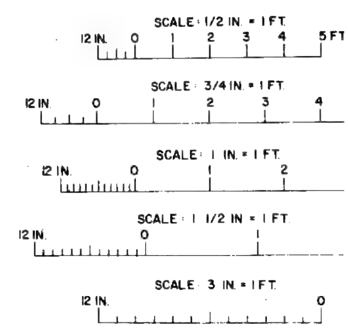
LOCATION OF PIEZOMETE		
GRAVITY DRAINAGE STRUCT		
PIEZ. NO.	STATION	OFFSET FROM CENTERLINE OF STRUCTURE-FT.
BF-1	48+76	47.5 L
BF-2	48+76	47.5 R
BF-3	55+18	45.0 L
BF-4	55+18	45.0 R
DP-1	54+53	45.0 L
SB-1	55+56.63	0
SB-2	54+73	0
AS-1	48+16	0
AS-2	48+66	0
UPPER WEIR		
BF-1	3+27	75.0 L
BF-2	3+27	75.0 R
BF-3	3+87	77.0 L
BF-4	3+87	77.0 R
W-1	3+58	0
SB-1	3+87	0

, Without ⅛"
ng Similar

metallic wellpoints
That produced by
Universal Oil Products
, St. Paul, Minn. 55164.

PUMPING PLANT

LOCATION OF PIEZOMETERS				
PIEZ. NO.	TYPE	STATION	OFFSET FROM CENTERLINE OF STRUCTURE - FT.	ELEVATION "A"
B-1	BACKFILL	20+85	112 Rt.	16.5
B-2	BACKFILL	22+20	96 Rt.	16.5
B-3	BACKFILL	20+85	112 Lt.	16.5
B-4	BACKFILL	22+20	96 Lt.	16.5
B-5	BACKFILL	23+72	96 Lt.	24.5
B-6	BACKFILL	24+28	120 Lt.	24.5
B-7	BACKFILL	23+72	96 Rt.	24.5
B-8	BACKFILL	24+28	120 Rt.	24.5
B-9	BACKFILL	23+44	240 Rt.	38.0
B-10	BACKFILL	23+20	240 Lt.	38.0
F-1	FOUNDATION	21+36	0	+5.0
F-2	FOUNDATION	21+36	60 Lt.	-5.0
F-3	FOUNDATION	22+82	60 Lt.	-5.0
F-4	FOUNDATION	23+72	60 Lt.	0.0
F-5	FOUNDATION	23+72	60 Rt.	0.0
F-6	FOUNDATION	22+82	60 Rt.	-5.0
F-7	FOUNDATION	21+36	60 Rt.	-5.0
US-1	UNDER-SLAB	21+86	18 Rt.	9.0
US-2	UNDER-SLAB	21+86	18 Lt.	9.0



TENSAS BASI
RED RIVER BACKWATE
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AND DRAINAGE ST
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STAFF GAGES AND PI

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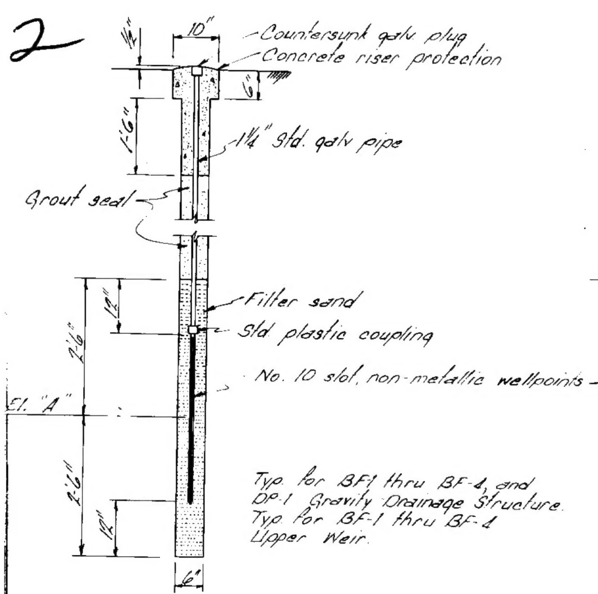
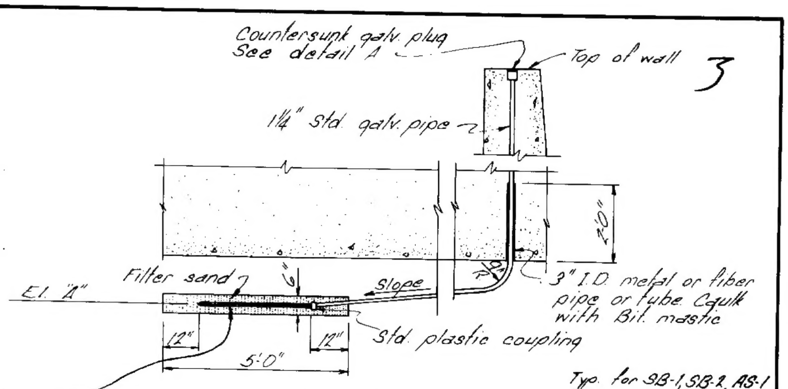
CORPS OF ENGIN
VICKSBURG, MISSI
DATE: AUGUST 1996



BACKFILL PIEZOMETER INSTALLATION DETAIL

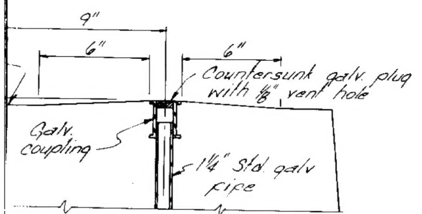
SCALE: 3/4 IN. = 1 FT.



HORIZONTAL PIEZOMETER INSTALLATION DETAIL

SCALE: 1/2 IN. = 1 FT.

Typ. for SB-1, SB-2, AS-1 & AS-2 Gravity Drainage Structure. Typ. for W-1 and SB-1 Upper Weir.



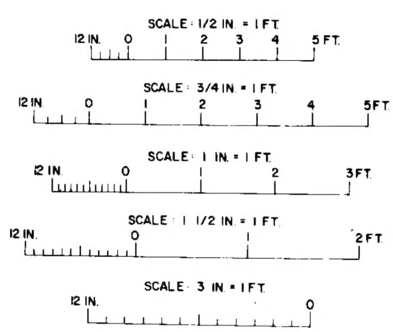
DETAIL A

SCALE: 3 IN. = 1 FT.

LOCATION OF PIEZOMETERS			
GRAVITY DRAINAGE STRUCTURE			
PIEZ. NO.	STATION	OFFSET FROM CENTERLINE OF STRUCTURE - FT.	ELEVATION "A"
BF-1	48+76	47.5 L	17.5
BF-2	48+76	47.5 R	17.5
BF-3	55+18	45.0 L	7.0
BF-4	55+18	45.0 R	7.0
DP-1	54+53	45.0 L	- 30.0
SB-1	55+56.63	0	0.5
SB-2	54+73	0	0.5
AS-1	48+16	0	20.5
AS-2	48+66	0	13.5
UPPER WEIR			
BF-1	3+27	75.0 L	23.0
BF-2	3+27	75.0 R	23.0
BF-3	3+87	77.0 L	23.0
BF-4	3+87	77.0 R	23.0
W-1	3+58	0	17.0
SB-1	3+87	0	17.0

PUMPING PLANT

LOCATION OF PIEZOMFTERS				
PIEZ. NO.	TYPE	STATION	OFFSET FROM CENTERLINE OF STRUCTURE - FT.	ELEVATION "A"
B-1	BACKFILL	20+65	112 Rt.	16.5
B-2	BACKFILL	22+20	96 Rt.	16.5
B-3	BACKFILL	20+65	112 Lt.	16.5
B-4	BACKFILL	22+20	96 Lt.	16.5
B-5	BACKFILL	23+72	96 Lt.	24.5
B-6	BACKFILL	24+28	120 Lt.	24.5
B-7	BACKFILL	23+72	96 Rt.	24.5
B-8	BACKFILL	24+28	120 Rt.	24.5
B-9	BACKFILL	23+44	240 Rt.	38.0
B-10	BACKFILL	23+20	240 Lt.	38.0
F-1	FOUNDATION	21+36	0	+5.0
F-2	FOUNDATION	21+36	60 Lt.	-5.0
F-3	FOUNDATION	22+82	60 Lt.	-5.0
F-4	FOUNDATION	23+72	60 Lt.	0.0
F-5	FOUNDATION	23+72	60 Rt.	0.0
F-6	FOUNDATION	22+82	60 Rt.	-5.0
F-7	FOUNDATION	21+36	60 Rt.	-5.0
US-1	UNDER-SLAB	21+86	18 Rt.	9.0
US-2	UNDER-SLAB	21+86	18 Lt.	9.0



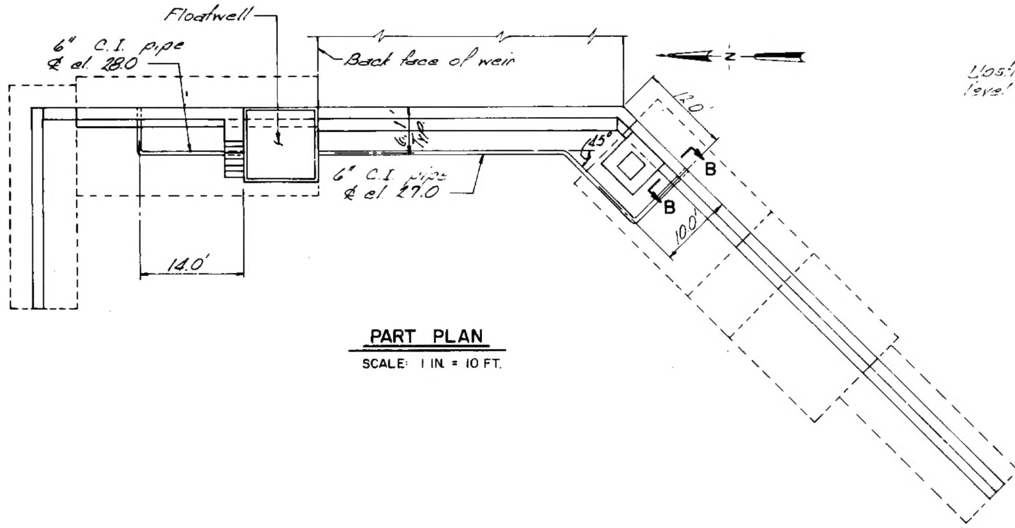
TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

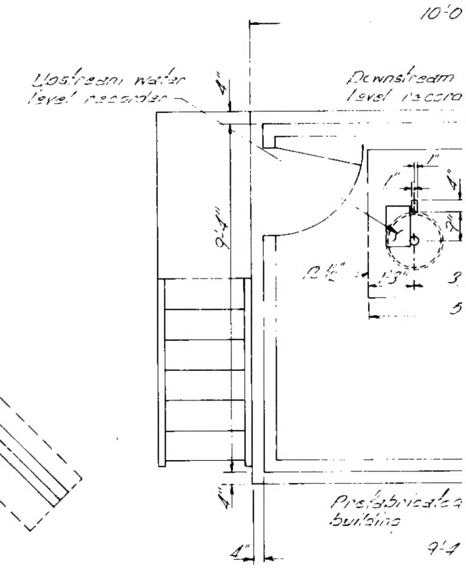
STAFF GAGES AND PIEZOMETERS

SCALE AS SHOWN
U. S. ARMY ENGINEER DISTRICT, VICKSBURG
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE NO: T-14-37



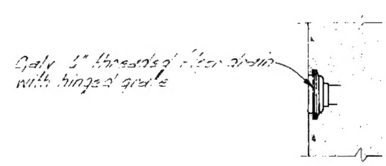
PART PLAN

SCALE: 1 IN. = 10 FT.



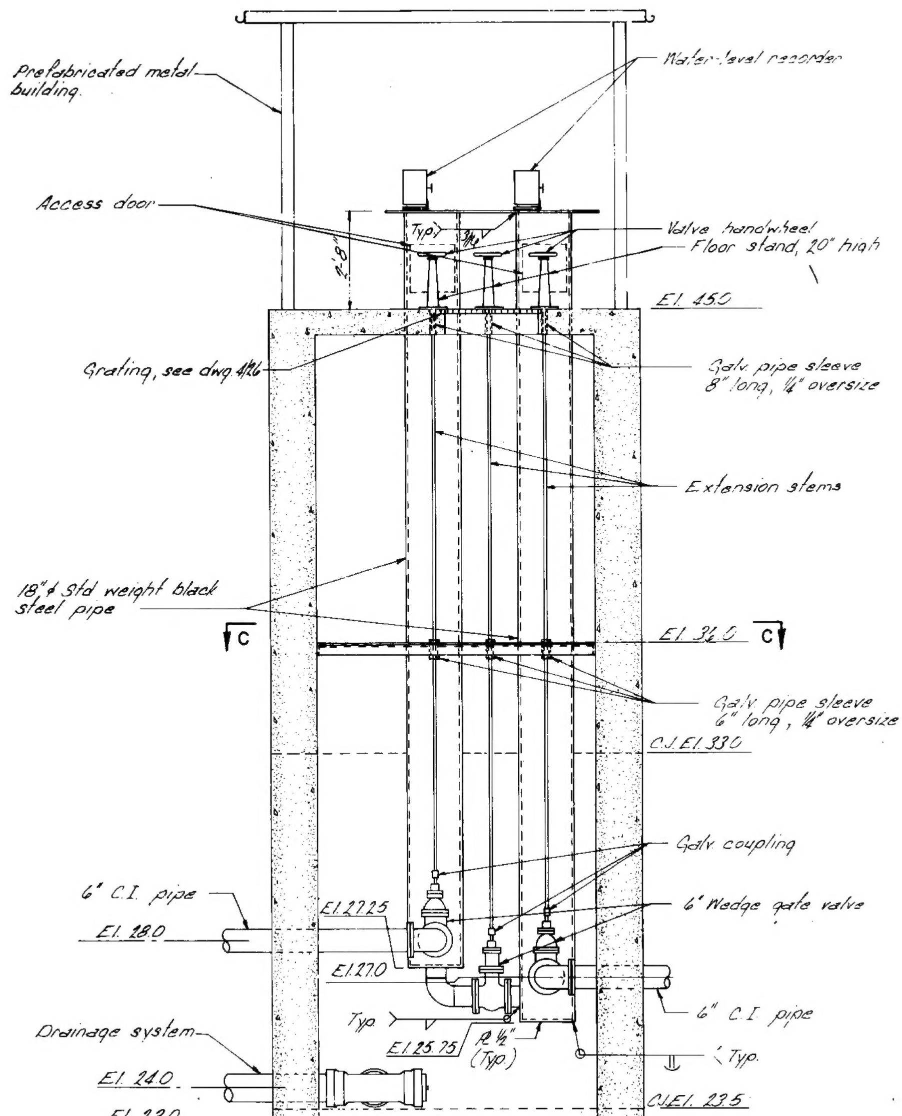
EQUIPMENT

SCALE: 1/2 IN.



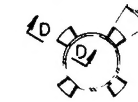
SECTION B

SCALE: 1/2 IN. = 1

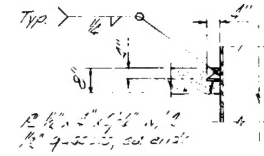


SECTION A-A

SCALE: 1/2 IN. = 1 FT.



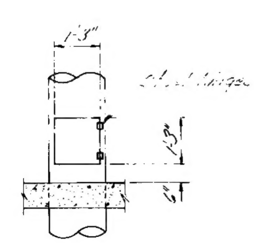
PLAN



SECTION D-D

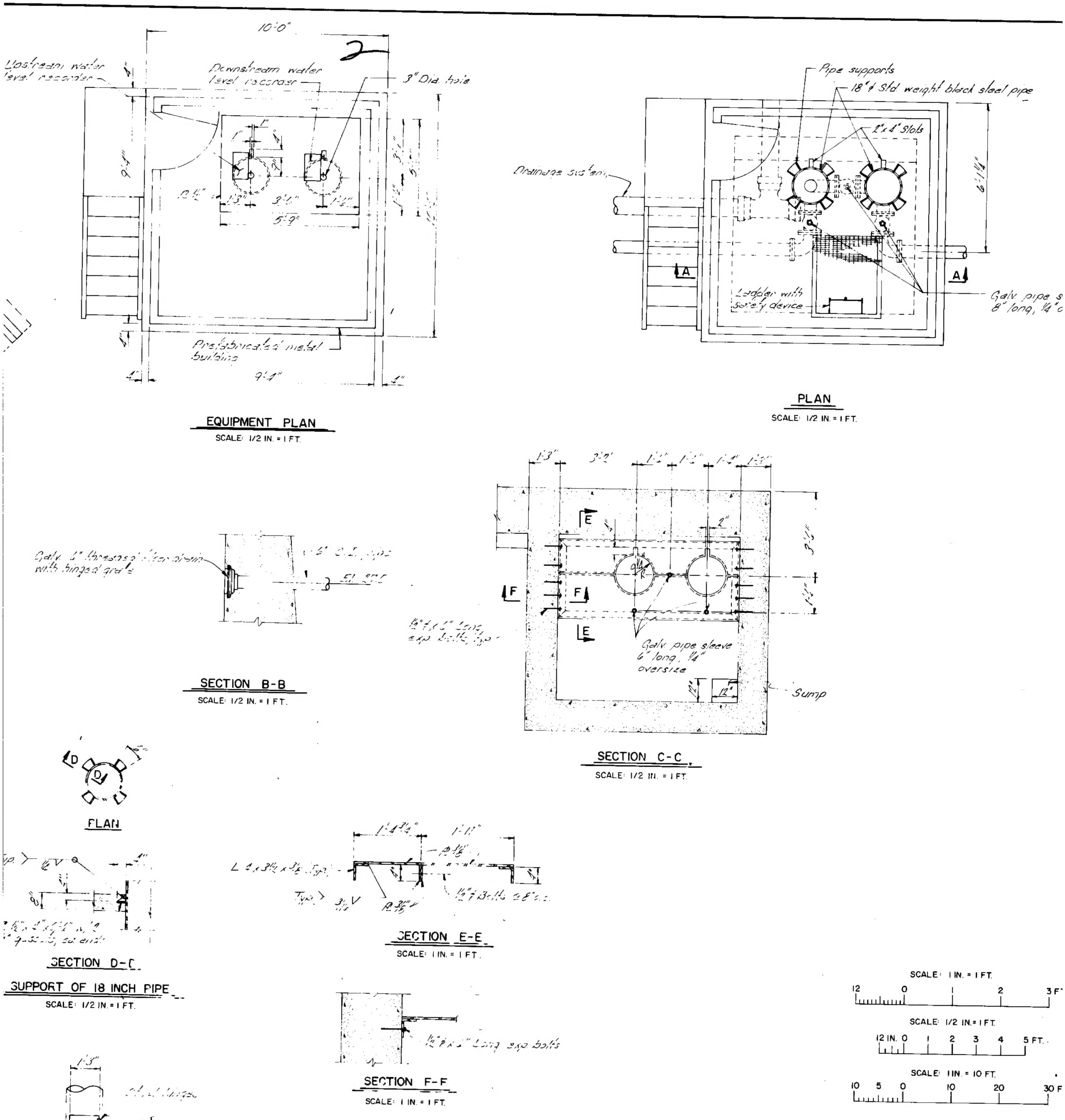
SUPPORT OF 18 INCH PIPE

SCALE: 1/2 IN. = 1 FT.



ACCESS DOOR DETAIL

SCALE: 1/2 IN. = 1 FT.



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPIN
AND DRAINAGE STRUCT
FOUNDATION REPORT

UPPER WEIR FLOATWELL DET

SCALE AS SHOWN
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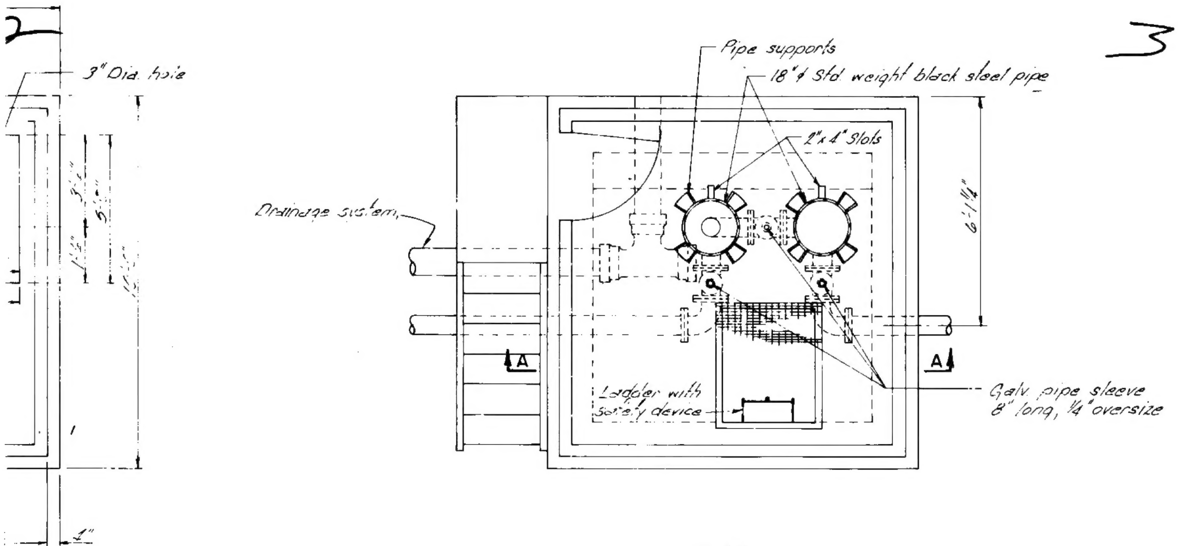
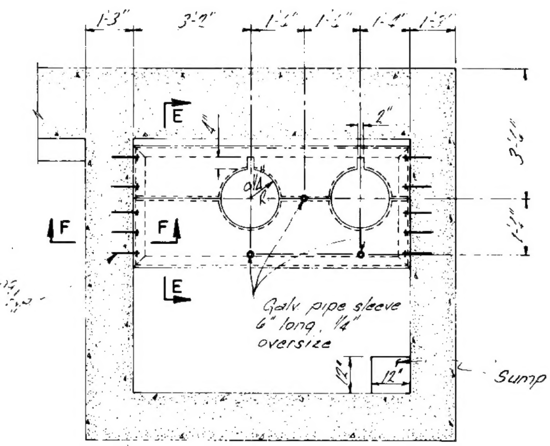
CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI
DATE: AUGUST 1996 FILE



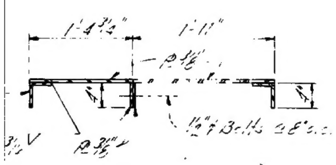
PLAN

SCALE: 1/2 IN. = 1 FT.



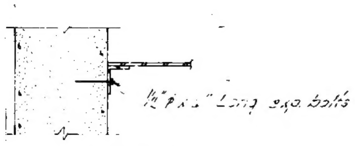
SECTION C-C

SCALE: 1/2 IN. = 1 FT.



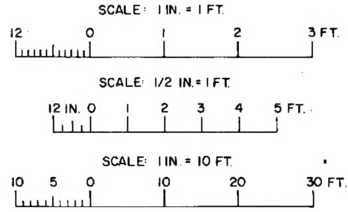
SECTION E-E

SCALE: 1 IN. = 1 FT.



SECTION F-F

SCALE: 1 IN. = 1 FT.



TENSAS BASIN
RED RIVER BACKWATER AREA
LOUISIANA

TENSAS-COCODRIE PUMPING PLANT AND DRAINAGE STRUCTURE

FOUNDATION REPORT

UPPER WEIR FLOATWELL DETAILS

SCALE AS SHOWN
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CORPS OF ENGINEERS
VICKSBURG, MISSISSIPPI

DATE: AUGUST 1996 FILE NO: T-14-37